JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA.

Vol. 5.—Part 1.

JANUARY, 1902.

PERTH:
BY AUTHORITY: WM. ALFRED WATSON, GOVERNMENT PRINTER.

1902

INDEX.

VOL. V.

January, 1902, to June, 1902, inclusive.

INDEX.

A.

B.

C.

D.

E.

F.

P.

R.

S.

T.

U.

W.

NOTES.

Grass for Breeding Sows.—There is no more wholesome diet for in-pig sows than green grass. In nature the pigs feed largely on green vegetable food, and there is nothing like studying nature's laws in caring for all pregnant animals. Hence, if the sows are given a run out for an hour or so once or twice a day when the sun shines they will assume healthy condition, and need all the less food indoors. Then, when farrowing time comes you may look for little trouble and a healthy family.

Feather-eating.—The habit amongst fowls of feather-eating is not a disease, but a vice which is often contracted through the birds being shut up in small runs without exercise. To prevent is better than cure, therefore prevent the birds from being idle. Give them hard food, such as wheat, millet seed, etc., and sprinkle it in a bundle of straw, or bury it in loose earth, and make them scratch for it. A little meat every day will often help them to overcome the habit. Abundance of green food is also necessary as a preventative.

Sparrows in Perth.—It has been reported to the Department of Agriculture that sparrows have again made their appearance in Perth. An officer of the Department has been told off to deal with the matter, and the secretary of the Department of Agriculture will be glad if anyone discovering sparrows will report to him without delay.

Famous Growing Country.—How great are the possibilities of Hawaii as a fruit and vegetable growing country will be understood, says an exchange, when it becomes known that four crops of potatoes have been produced in succession on the same piece of land within twelve months. Radishes become edible in ten days after showing. Strawberry vines bear fruit all the year. The berries are of the finest flavour. Cabbage grows all the year, and it apparently makes no difference whether it is planted in the spring, summer, autumn, or winter. Parsley once sown grows for ever, apparently. Lima beans continue to grow and bear for over a year, and they have to be gathered every week after starting to bear. Cucumbers bear the entire year, and so do tomatoes, which, with proper attention, bear for years. Raspberries bear for six months. Pineapples come into bearing when the plants are four months old, and bear in abundance for years. Lettuce can be planted at any time and it develops quickly. The same is true of celery.

Thick and Thin Sowing.—The advantages or disadvantages of thick or thin seeding were subjected to a test in New South

Wales last year. Wheat sown in drills 1in. apart yielded 10 bushels 37lb. per acre; seed sown 2in. apart in drills gave 6 bushels 12lb. per acre; and so on, proving that it is improvident to sow too thickly. The yields, by the way, hardly indicate successful cultivation, though planting was very late. It was surely the principle of the thing that required demonstration.

Pure Milk Supply.—The Minister of Agriculture for Victoria has been supplied by an expert, now in London, with a description of the dairy and depôt of the Manchester Pure Milk Supply Company, Limited, at Old Trafford. The company's milk is purchased from farmers, who are all under contract to use only sound, wholesome fodder for cows approved by the company's veterinary inspector. No milk except that from cows certified to be free from tubercle is sent to the dairy. The farm and the employees are periodically subjected to medical inspection. When any of the employees suffer from sickness of a serious nature, or come into contact with persons suffering from contagious or infectious disease, they are paid full wages during such time as they are considered unfit to handle the milk. As soon as the milk is drawn from the cows, it is at once cooled in ice, supplied by the dairy to all the company's farms, and remains in a thoroughly cooled state till lodged at the dairy. This is an important feature in minimising the development and growth of bacteria. The milk is conveyed to the dairy in the company's own cans, which have been previously cleansed by using hot water and soda, then steaming, and finally flushing with lime water. The handling of the milk at the farms is supervised by the company's representatives. On arrival at the dairy the temperature of each can of milk is taken, and if above 45 degrees Fahrenheit it is rejected. A sample is also taken for testing for butter fat, and when below 3·5 p.c. it is sent back to the farm. Precautions of the same thoroughness are carried out right through the various dairying processes and the subsequent distribution. It is evident from these particulars that milk supply companies in Australia have still plenty of scope for improving their methods.—*The Age.*

Clover and Cow-pea for Poultry.—Reference has been made, says the *Rural New Yorker*, to the usefulness of Crimson clover and cow-peas as hen forage. We are able to report an increasing partiality for these nitrogenous foods among the two flocks of chickens kept on the Rural Grounds, and correspondingly good results in the way of egg production. Hens readily take to clover in any variety, but they are often shy of beans, seldom eating them uncooked. An appetite for raw peas or beans may be considered an acquired taste coming on gradually. Our hens ignored the cow-pea seeds the first season they were grown here, and only developed the taste late in the winter, when scratching the pods open by chance in a sheltered part of the field. The example

of contented old biddies coming in with comfortably extended craws, and an urgent thirst for water to complete the swelling process, proved contagious, and they all now hurry to the field at once on being released from the yard. There can be no doubt as to the beneficial effect of the exercise needed to get the pods open, nor of the high food value of the beans themselves. The Rural Grounds lie in a strip about 800 feet long by 200 feet wide. There are poultry houses near each end, and the flocks have but little chance to mingle, as they are necessarily kept yarded most of the time, yet the cow-pea habit, which we heartily approve, seems to have been communicated. The second flock has no access to the fields, but acquired the taste from scratching the gathered pods shelled for seed. An increase in egg yield was noted in both cases as quickly following the ripening of the early black cow-peas, which is the variety best suited for us. Cow-pea seeds, when ready for market, are too costly for poultry food, but we are convinced that a patch of these hustling land improvers handy to the chicken yard is a good investment where practicable. Crimson clover has become a necessity, sown in August between bush fruits and after early crops, to improve our soil and diminish washing by winter rains, and incidentally as forage for the fowls, who keep the more accessible strips sheared as closely as with a lawn mower. The season has been favourable and the plants on early-sown strips are now seven to eight inches high, but we find such leafy plants do not, as a rule, winter as well as those closely picked by the fowls. Chickens are fond of green food, but eat very few weeds with relish. If not provided with clover in this manner they are very troublesome on the lawn, when at liberty. These clover strips entice them away, and thus fit in all along the line.

Feeding Cattle on Young Sorghum.—If cattle or horses are turned in to graze upon sorghum, maize, or other green fodder whilst they are very hungry, it is highly probable they will become "blown" (tympanitis), and many will die. It is never to be recommended to turn stock on to young sorghum or maize. The plants are best when the seeds begin to become firm. A full crop of seed and a crop of green fodder can thus be secured, and danger of bloat can thus be avoided.

Crop Rotation.—An intelligent crop rotation should always be selected and rigorously adhered to upon every farm, but no iron rule can be laid down that will apply to all cases. However, some crop of the leguminous family should as a rule come into crop rotation once in five or six years, as it possesses the power of restoring the fertility to the soil in a degree that no other crop does. Most leguminous crops are paying in themselves and they aid greatly in keeping up the nitrogen supply in the soil, without going to the expense of buying it in commercial fertiliser. Some varieties of clover, cow peas, soja beans, etc., will usually succeed well enough to warrant raising.

THE INSECTIVOROUS BIRDS OF WESTERN AUSTRALIA.

By Robert Hall.

CHATS.

So small a genus of birds beyond the vegetation of the tropics more beautiful than this one is seldom likely to see. It consists only of four species, all found in our State, and nowhere other than Australia. Each is highly useful as a destroyer of insect life. One in a blazon of red, two others of rich yellow, and the fourth of strongly contrasted black and white, make pretty pictures wherever they move. Associating in flocks, most often each in its own, they pass over hundreds of miles of country of hot and stinted growth in their migratory course from North to South during spring. After rearing, as a rule, two families of each three to four young, they move back upon much the same course in the autumn. This refers to the Southern portion of the State. As to what the Northern members do is not a matter with which we are quite familiar, but I should say they all have the instinct to move in a body, as most other birds do when the desire for migration comes to them. The White-fronted species is simply nomadic.

Orange-fronted Chat.

Ephthianura aurifrons, Gld. (Ef'thi-a-nu'ra â-ri-frons).

Ephthos, languid; *oura*, tail; *aureus*, golden; *frons*, forehead.

Ephthianura aurifrons, Gould, "Birds of Australia," fol., vol. iii., pl. 65; "Key to the Birds of Australia," Hall, p. 30 (1899).

Geographical Distribution—Areas 9, 7, 6.

Key to the Species—

Male.—Golden yellow on crown, breast, and rump; throat black; bill slender, about equal in height and breadth at nostrils.

Female.—Head brown and under surface paler. Total length, 4 inches.

Young Male.—Upper tail coverts, only, red.

A glance at the "Key to the Species" will indicate at once the bird to which is referred. Another form (*E. crocea*) is only found in the extreme North of the State, while this is said to be a Southern bird. *E. crocea* has a yellow throat and a black band across the chest. A third species (*E. tricolor*) has the forehead, crown, breast, and upper tail coverts crimson on the male, and faint red on the female. This latter bird is now found in the North, and, as I write, the first record of it, I believe, is thus made. It has generally been thought to be a Southern bird. The question of the distance of its migratory course is before us; and not yet settled. Mr. J. P. Rogers, Derby, sent specimens to me from there,

while I have observed the birds alive in the direction of the Murchison. We all know them in the South.

The Chats are fond of scrubby country, and may be seen in a flock of about a dozen hopping about the ground in the bushes. I can indorse the sentiments of other naturalists about being struck with the remarkable beauty of these birds. When first seen by myself a pair of *E. tricolor* was flitting about the salt bushes in search of insects.

Being September they were arranging material for a nest in one of the bushes. In a September colony some birds had fresh eggs, others had young, and a few nests were being built in preparation for the eggs.

Nest.—Open, cup-shaped, with fairly broad lip and base; made of grasses, and lined with animal hair or grass; placed near or on the ground, in or at the base of a shrub.

Eggs.—Four or five to a sitting; white ground with spots of reddish brown; zone of spots generally around the broader end. Length, 0·65 inch; breadth, 0·5 inch.

White-fronted Chat.

(*Jenny Wren, Tang.*)

Ephthianura albifrons, Jard. and Selb. (*Ef'thi-a-nu'ra alb'i-frons*).

Ephthos, languid; *oura*, tail; *albus*, white; *frons*, forehead.

Ephthianura albifrons, Gould, "Birds of Australia," fol., vol. iii., pl. 64; "Key to the Birds of Australia," Hall, p. 30 (1899).

Geographical Distribution—Areas 9, 8, 7, 6, 4.

Key to the Species.—

Male.—Black crescent across white breast; throat, white; forehead, white; hinder crown, black; bill, slender. Total length, 4in.

Female.—The blacks and whites are much reduced in contrast, and all the parts are grayer.

This active ground-loving bird is the most numerous of the genus. It associates in flocks, between January and July, upon the high grass and low bushes of the open country, uttering its "tang," and becoming as pugnacious as many other birds before the end of July. This is one of four very beautiful and conspicuous species of a genus just referred to as peculiar to Australia. It is nomadic only, unless with an exceptionally severe season it may leave the most Southerly parts of the State, and, even then, it is, figuratively speaking, still nomadic. All build their nests at the bases of herbs or grasses, or some 18 inches from the ground, amongst bushes. The birds are early builders, make a cup-shaped nest, deposit three eggs (one on each successive day), and induce the young to leave the nest on the twelfth day from the time of birth. The young are not born on the same day, but with 24 hours' difference in time. The eyes do not open until two or three days before the birds are about to leave the nest. This applies to the

young of many small birds, but not all, *e.g.*, the quail and others. If an egg does not develop, it lies in the nest for weeks, perhaps till decay sets in; in any case, long after the nest is unused by the owners. Both sexes take part in incubation and in the rearing of the young, the male taking as keen an interest in the acting of a canopy for the new-born as the mother bird.

White-Fronted Chat.

Here is another foster-parent for the narrow-billed bronze cuckoo. In a recent December I found an egg of the parasite unsuccessfully foisted upon a pair of chats, for it had either not been placed in the nest or had been ejected to the wide edge. There it lay uncared for. During three successive seasons two pairs of this species built their nests at the bases of the same three tussocks of grass. I believe them to have been the same birds throughout the time. There were thousands of other tussocks in the vicinity that could have been utilised for the same purpose, without any special effort on the part of the birds—at least, as far as my knowledge of such matters led me to conclude.

Nest.—Open, cup-like, with broad lip and still broader base; made of grasses, and lined with animal hair or fine grass;

placed close to the ground in a shrub or on the ground under a thistle.

Eggs.--Three or four to a sitting, white ground, with spots of reddish-brown, inclined to form a zone towards the broad end; length, 0·65 inch ; breadth, 0·5 inch.

KINGFISHERS.

The birds we term Kingfishers are as much hunters of beetles as true fishers. It may come as a surprise to learn the following species are particularly useful birds, and of strong advantage to us. Were I asked to supply a testimonial in their favour, I should certainly testify to the high character the smaller, if not the larger, bear. They are brave little "souls" in the defence of their young, and feed on what may be termed destructive insects.

Little, if any, wrong is known against their names, and the good-will towards them is such that damaging evidence is not likely to be forthcoming.

Australia, a zoological sub-region of the Australian region, has five types of Kingfishers, which, for our present purpose, may be divided into "water" and "land" fishers. The water birds are again divided into (*a*) short tails, (*b*) long tails; and the land birds into (*a*) saw-like bills, (*b*) giant bills, (*c*) normal bills. It is under (*b*) of the second section our friend the Jackass takes its place. The three members of this genus are disposed, in two cases, strongly on the Eastern side of our continent, and in the third on the Northern. It is very rarely a specimen of any is seen in the great South-West, which species is still a doubtful matter, and a possible caged bird let loose.

Fawn-Breasted Kingfisher (Laughing Jackass).

Dacelo cervina, Gld. (*Da-se'lo cer-vi'na*).

Dacelo, a transposition of *alcedo*, a kingfisher ; *cervinus*, of a deep fawn colour.

Dacelo cervina, Gould, "Birds of Australia," fol., vol. ii., pl. 20; "Key to the Birds of Australia," Hall, p. 57 (1899).

Geographical Distribution—Areas 9, 8, 2, 1.

Key to the Species.—

Head, distinctly striped ; portion of wing and upper tail coverts, blue ; upper surface, strongly marked ; under surface, slightly fulvescent.

Male has blue tail, adult female has cinnamon tail barred with blue. Total length, 15 inches.

D. cervina is said to be a sub-species of *D. leachii* of the Northern Territory, because it is two inches shorter in the total length. This is its present position in a scheme of classification. The stronghold is in the Northern portion of our State, but it has been found in the central area.

The voice of the bird is an extraordinary one, and said by some early settlers to indicate the bush to be full of evil spirits. Certain

it is that from a high dead bough it pours forth its merry laughter. Early to rise and early to bed has earned for it the name of "bushman's clock." The natives say it breeds during the honey season, which is May, June, and July. The food is thought by Mr. Gould to be similar to that of *D. gigas*, *i.e.*, insects. The food of the latter, the Eastern species, is certainly a mixed quantity, as insects, lizards, snails, crabs, and even rats are pulped for immediate home consumption. To give an idea of certain facts in the economy of its ally, *D. gigas*, I quote from observations on a specimen under domestication. A neighbour has a bird which has shown a weakness for a variety of animate things, besides home luxuries. A bandicoot, as large as itself, was the first trial of strength I knew of. The bird occupied three-quarters of an hour in pounding it to a jelly appearance, then the anterior end disappeared. A day was occupied in the digestion and recovery. A rat, later in the week, was similarly pounded and devoured as a whole. On two successive days, within the same month of experiments, sixteen lizards *(Hinulia, sp.)* and seven bloodsuckers *(Amphibolurus, sp.)* were successfully managed, as if the undertaking was quite a pleasure throughout. A copper-headed snake, two feet in length, and having the head dismembered, was a third banquet, and it was similarly managed. The same bird, in November killed its cage mate, a collared crow-shirke, and of course swallowed it. This was a case of the biter bit. The last note was sufficient to satisfy me of its indifference as to what comes first, providing it is substantial.

Nest.—Simply a hollow of a tree, with decayed wood upon which to deposit the eggs.

Eggs.--Two or three to a sitting; pearly white. Length, 1·7 inches; breadth, 1·3 inches.

Sacred Kingfisher (Wood Kingfisher).

Halcyon sanctus, Vig. and Hors. (*Hal'si-on sangk'tus*).

Hals, the sea; *kuein*, to breed; *sanctus*, sacred.

Halcyon sanctus. Gould. "Birds of Australia," fol., vol. ii., pl. 21; "Key to the Birds of Australia," Hall, p. 57 (1899).

Geographical Distribution.—Over the whole of the continent and occasionally in Tasmania.

Key to the Specie.—Head greenish blue, upper surface varying between dull green and blue; under surface of body and under wing coverts orange-buff, as also the collar; bill compressed; culmen grooved laterally.

In most respects, as the following species, the Sacred is not piscatorial in its ways. Far from it; because of all birds, even those of the desert, it is able to live away from water for months, and live upon lizards, small snakes, beetles, and grasshoppers. The isolation of the bird is remarkable. In Central Australia, and in nearly all the coastal arid parts, it may be seen, provided a clump

of dry-looking "gums" is there. In the extreme South it is migratory as the winter advances, though this does not apply to the warmer districts just North of it. It is essentially a hot weather bird.

The cry is penetrative, being clear and sharp. If, when you are passing through timbered lands, you find the Halcyon vocally active you will know that it has a nest very near in a hollow of a tree. In all probability the mate is sitting upon the eggs, from which you will not easily get it away, as this species is very persistent in its own way. Halcyons are helpful to agriculturists. The birds bear two families in a season.

To say that the Kingfisher is a breeder on the sea is out of place with our present knowledge, but Aristotle, the first historical ornithologist of any note, arranged a fable. For 14 days in mid-winter, he says, the birds remain and make nests on the rocks of the Grecian seas, and the sea remains calm. During this time the nest is built and the young are reared, while on the seventh day after the longest day of the year the birds pass away. It is simply a fable, and probably the presence of the Kingfishers means an act of migration, as they quickly come and go far too rapidly for this part of the life-history of any known bird.

Nest.—A hollow of a tree with a small entrance, and decayed wood to act as a floor for the eggs. Sometimes a hole drilled in a creek bank.

Eggs.—Four or five to a sitting, pearly white and nearly round. Length, 1in.; breadth, 0·9in.

Red-backed Kingfisher.

Halcyon pyrrhopygius, Gld. (*Hal'si-on pyr-o-pig'i-us*).

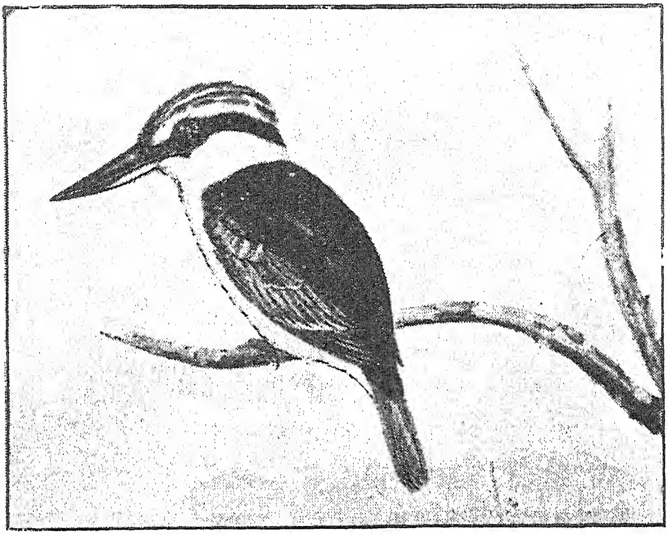
Hals, the sea; *kuein*, to breed; *purros*, reddish; *pyga*, rump.

Halcyon Pyrrhopygia, Gould, "Birds of Australia," fol., vol. ii., pl. 22; "Key to the Birds of Australia," Hall, p. 57 (1899).

Geographical Distribution—Australia, except Tasmania.

Key to the Species.—Head, green, streaked with white; under surface, white; back and rump, cinnamon; bill, long, slender, and compressed; culmen grooved laterally.

In general habits this species agrees with the preceding one. It is rather fonder of creeks in their dry stage, but whether this is because of the facility given for nest building in the bank sides or not I cannot say. Near Geraldton it is common, and about the inner Swan one may see it. The distribution of the species is very wide. I cannot but remark upon the filthy condition of this bird's nest. Sanitary laws are not observed. It is quite the exception in our avifauna to find a pair of birds rearing ten young during a season in the dirtiest and foulest hovel imaginable. Apparently diphtheria is not catchy in Kingfishers' fledglings. The food is mainly insects.



Red-backed Kingfisher.

Nest.—A tunnel in the bank of a creek, at the end of which is an enlarged cavity, where the eggs are placed.

Eggs.—Four or five to a sitting; pinky white. Length, 1 inch; breadth, 0·8 inch.

BACK NUMBER OF JOURNAL REQUIRED.

Any person having a copy or copies of the January issue of last year, 1901, of the *Journal*, will oblige by sending same in to the Editor, Department of Agriculture, Perth. Sixpence will be paid for each copy.

PLAIN TALKS ON MANURES.

Percy G. Wicken.

(Continued from Vol. 4, p. 393.)

Cabbages, Cauliflowers, etc.

Apply at time of transplanting or sowing seed.

			Cost. £ s. d.
Bonedust	560lbs.	...	1 17 6
Sulphate of Potash ...	224lbs.	...	2 0 0
	7cwt.		£3 17 6

Cost of mixture per cwt., 11s. 1d.

Apply at the rate of 3cwt. per acre.

When the heads are just beginning to form, apply as a top dressing—

			Cost. £ s. d.
Sulphate of Ammonia	112lbs.	...	0 18 0
Superphosphate ...	112lbs.	...	0 7 6
Sulphate of Potash ...	56lbs.	...	0 10 0
	2½cwt.		£1 15 6

Cost of mixture, 14s. 1d. per cwt.

Apply at the rate of 112lb. per acre. The total cost of the two applications will be £2 7s. 4d., and will supply to the soil—

Nitrogen	18lbs.
Phosphoric Acid	58lbs.
Potash	61lbs.

Maize and Sorghum.

			Cost. £ s. d.
Blood Manure ...	336lbs.	...	0 19 6
Bonedust	224lbs.	...	0 15 0
Superphosphate ...	448lbs.	...	1 10 0
Sulphate of Potash ...	112lbs.	...	1 0 0
	10cwt.		£4 4 6

Cost of mixture per cwt., 8s. 6d.

Apply at the rate of 4cwt. per acre, at the time of sowing the seed; the cost will be 34s., and will supply to the ground per acre—

Nitrogen	18lbs.
Phosphoric Acid	62lbs.
Potash	24lbs.

Pumpkins, Melons, etc.

			Cost. £	s.	d.
Blood Manure ...	...	448lbs.	1	6	0
Superphosphate	...	560lbs.	1	17	6
Sulphate of Potash	...	112lbs.	1	0	0
		10cwt.	£4	3	6

Cost of mixture per cwt., 8s. 4d.

Apply a good handful to each hill, or at the rate of 2cwt. per acre, the cost will be 16s. 8d., and will supply to the ground per acre—

Nitrogen	9lbs.
Phosphoric Acid	28lbs.
Potash	12lbs.

Blood manure is not always obtainable in this market, and some other form of nitrogenous manure must be substituted for it containing the same amount of nitrogen.

Tomatoes.

			Cost. £	s.	d.
Sulphate of Ammonia		336lbs.	2	14	0
Superphosphate	...	560lbs.	1	17	6
Sulphate of Potash	...	336lbs.	3	0	0
		11cwt.	£7	11	6

Cost of mixture per cwt., 13s. 9d.

Apply at the rate of 4cwt. per acre, the cost will be £2 15s., and will supply to the ground per acre—

Nitrogen	24lbs.
Phosphoric Acid	52lbs.
Potash	60lbs.

Onions.

			Cost. £	s.	d.
Blood Manure ...	...	448lbs.	1	6	0
Bonedust ...	...	336lbs.	1	2	6
Superphosphate	...	112lbs.	0	7	6
Sulphate of Potash	...	224lbs.	2	0	0
		10cwt.	£4	16	0

Cost of mixture per cwt., 9s. 6d.

Apply a little before or at the time of sowing seed, at the rate of 4cwt., and 1cwt. as a top dressing when plants are well forward per acre, cost £2 7s. 6d., and will supply to the ground—

Nitrogen	31lbs.
Phosphoric Acid	45lbs.
Potash	54lbs.

Potatoes.

			Cost. £ s. d.
Blood Manure ..	...	448lbs.	... 1 6 0
Superphosphate	...	560lbs.	... 1 17 6
Sulphate of Potash	...	224lbs.	.. 2 0 0
		11cwt.	£5 3 6

Cost of mixture per cwt., 9s. 5d.

Apply at the rate of 4cwt. per acre in drills with the seed, at a cost of £1 17s. 8d., and this will supply to the ground—

Nitrogen	18lbs.
Phosphoric Acid	50lbs.
Potash	40lbs.

Mangels.

			Cost. £ s. d.
Sulphate of Ammonia		448lbs.	... 3 12 0
Bonedust ...	...	224lbs.	... 0 15 0
Superphosphate	...	336lbs.	... 1 2 6
Kainait	...	448lbs.	... 1 0 0
		13cwt.	£6 9 6

Cost of mixture per cwt., 10s.

Apply at the rate of 5cwt. per acre, at a cost of £2 10s., and this will supply to the ground per acre—

Nitrogen	37lbs.
Phosphoric Acid	50lbs.
Potash	22lbs.

Mangels are a very gross feeding plant, and require a liberal supply of manure. They are largely benefited by the application of salt, and if kainait cannot be obtained and sulphate of potash has to be substituted in its place, a dressing of salt at the rate of 200lbs. or 300lbs. per acre will prove beneficial.

Turnips, Rape, etc.

			Cost. £ s. d.
Sulphate of Ammonia		112lbs.	... 0 18 0
Bonedust ...	...	336lbs.	... 1 2 6
Superphosphate	...	336lbs.	... 1 2 6
		7cwt.	£3 3 0

Cost of mixture per cwt., 9s.

Apply at the rate of 3cwt. per acre, and the cost will be £1 7s., and will supply to the ground per acre—

Nitrogen	15lbs.
Phosphoric Acid	63lbs.

Tobacco.

			Cost. £ s. d.
Sulphate of Ammonia	448lbs.	...	3 12 0
Superphosphate ...	336lbs.	...	1 2 6
Sulphate of Potash ...	336lbs.	...	3 0 0
	10cwt.		£7 14 6

Cost of mixture per cwt., 15s. 6d.

Apply at the rate of 5cwt. per acre, at a cost of £3 17s. 6d., and this will supply to the ground per acre—

Nitrogen	45lbs.
Phosphoric Acid	41lbs.
Potash	80lbs.

Grape Vines.

			Cost. £ s. d.
Sulphate of Ammonia	448lbs.	...	3 12 0
Superphosphate ...	448lbs.	...	1 10 0
Sulphate of Potash ...	224lbs.	...	2 0 0
	10cwt.		£7 2 0

Cost of mixture per cwt., 14s. 2d.

Apply at the rate of 4cwt. per acre, and the cost will be £2 16s. 8d., and will supply to the ground per acre—

Nitrogen	36lbs.
Phosphoric Acid	44lbs.
Potash	42lbs.

In soils that are deficient in lime, the superphosphate should be reduced by one-half, and gypsum used instead of it.

Citrus Fruits.

			Cost. £ s. d.
Bonedust	560lbs.	...	1 17 6
Superphosphate ...	224lbs.	...	0 15 0
Sulphate of Potash ...	336lbs.	...	3 0 0
	10cwt.		£5 12 6

Cost of mixture per cwt., 11s. 3d.

Apply at the rate of 4lbs. per tree (according to size), equal to 400lbs. per acre, at a cost of 39s. 6d., or 4¾d. per tree.

This will supply to the ground per acre—

Nitrogen	8lbs.
Phosphoric Acid	61lbs.
Potash	60lbs.

Apples and Pears.

			Cost. £ s. d.
Bonedust	560lbs.	...	1 17 6
Superphosphate ...	336lbs.	...	1 2 6
Sulphate of Potash ...	336lbs.	...	3 0 0
	11cwt.		£6 0 0

Cost per cwt. of mixture, 11s.

Apply at the rate of 3½lbs. per tree (according to the size of the tree), equal to 350lbs. per acre, at a cost of 33s., or 4d. per tree.

This will supply to the ground per acre—

Nitrogen	6lbs.
Phosphoric Acid	51lbs.
Potash	42lbs.

If the trees are looking yellow, it is probably due to a want of nitrogen, and a dressing of sulphate of ammonia, at the rate of 1lb. per tree, will probably prove beneficial. The extra cost will be about 1½d. per tree.

Stone Fruits.

			Cost. £ s. d.
Sulphate of Ammonia	224lbs.	...	1 16 0
Superphosphate ...	560lbs.	...	1 17 6
Sulphate of Potash ...	224lbs.	...	2 0 0
	9cwt.		£5 13 6

Cost of mixture per cwt., 12s. 7d.

Apply at the rate of 3½lbs. per tree (according to size), equal to 350lbs. per acre, at a cost of 39s. 4d. per acre, or 4¾d. per tree.

This will supply to the ground per acre—

Nitrogen	16lbs.
Phosphoric Acid	48lbs.
Potash	39lbs.

Standards adopted.—The standards adopted in working out the above calculations are as follow:—

		%		%
Boiling down refuse ...	Nitrogen	7	Phosphoric Acid	9
Bonedust	Nitrogen	4	Phosphoric Acid	20
Superphosphate ...	...	...	Phosphoric Acid	25
Sulphate of Potash ...	...	...	Potash	53
Blood manure	...	...	Nitrogen ...	11
Sulphate of Ammonia ...	...	...	Nitrogen ...	20

The figures given will be found correct, omitting fractions.

The percentages given may be considered rather high, but a good sample of each manure should contain the quantities stated.

Substitution.—In the event of one manure being substituted for another, care must be taken to use a quantity that will give the same amount of the ingredient required as the manure which is to be replaced.

For instance, supposing blood manure or boiling down refuse is unobtainable, and sulphate of ammonia has to be substituted in its place, only about half the quantity will be required, as 100lbs. of sulphate of ammonia contain 20lbs. of nitrogen, and 100lbs. of blood manure 11lbs.; 100lbs. boiling down refuse, 7lbs. Nitrate of soda is not mentioned in the formulas given, on account of its cost, but may be substituted for sulphate of ammonia if occasion requires; it is more expensive than sulphate of ammonia, and has to be imported from abroad, while sulphate of ammonia is produced within the States, both in Sydney and Melbourne. Each 100lbs. of sulphate of ammonia contains 20lbs. of nitrogen, at a cost of 18s., and each 100lb. of nitrate of soda contains 15lbs., at a cost of 15s. The difference in the price of these two ingredients in the Eastern States is more striking owing to sulphate of ammonia having no freights to pay, whereas here we have to import both. It is principally a question of cost in the choice between the two manures. In substituting one manure for another care should be taken, however, to try and substitute a manure somewhat similar in condition to that replaced; for instance it is better to substitute boiling down refuse or nipho, for blood manure, than it is to use sulphate of ammonia. In potash manures, kainait may be substituted for sulphate of potash. Kainait is a white salt, and contains one-fourth the percentage of potash (13 per cent.) that sulphate of potash does, and is quoted at one quarter the price, therefore it is necessary to use four times the quantity to supply an equal amount of potash.

In substituting one form of superphosphate for another, care must be taken to supply one having about the same percentage of "water soluble" phosphoric acid. If basic slag or Thomas phosphate is used instead of bone phosphate, it had better be applied separately; as noted under the heading of "Manures for Wheat," it is very largely composed of insoluble phosphoric acid, and contains 18·31 per cent.; its actual value as a manure at current Perth rates would be about £2 10s., whereas the price asked is just double, viz., £5.

Manure for Small Areas.—In all the manures mentioned in the above notes I have quoted the amounts per acre as a basis, as in all farming operations an acre is the standard measurement. However, for those having only small areas of land, it is very easy to calculate the quantities to use. For a square chain, or one-tenth of an acre, the quantity required will be one-tenth of the amount recommended, or say 11lbs. per chain for each cwt. of manure. To come to a smaller area again, for each square yard will be required about one-third of an ounce for each cwt. of manure to be applied per acre.

For those wishing to use these formulas for a small area, and who only require to use a small quantity of the manures mentioned, it will be a very simple matter to strike off the two last figures mentioned; thus, for example, that for onions:—

Blood manure	448lbs.	will be	4lbs.
Bone dust	336lbs.	„	3lbs.
Superphosphate	112lbs.	„	1lb.
Sulphate of Potash	224lbs.	„	2lbs.

and mix any quantity you may require in the proportions of 4, 3, 1, 2, and this will give a result sufficiently accurate for garden purposes.

What Crops take from the Soil.

A crop of wheat yielding 30 bushels of grain to the acre, or about 2 tons of grain and straw, removes from the soil during the period of growth 48lbs. of nitrogen, 21lbs. of phosphoric acid, and 29lbs. potash. The wheat crop depends entirely upon the soil for its supply of nitrogen. Forty-eight lbs. nitrogen is equivalent, roughly speaking, to about ·003 per cent. in a soil 6 inches deep, a quantity much less than that contained in the average soil, which is about ·1 per cent. It will be seen by this that if the nitrogen in the soil were available, there would be plenty in the poorest soil to supply a number of crops; but the crop does not possess the power of utilising the soil nitrogen to its full extent, and therefore the application of a soluble nitrogenous manure is desirable to furnish the crop with a full supply of nitrogen. In a wheat or cereal crop, three-quarters of the nitrogen is contained in the grain, and about one-quarter in the straw. Twenty-one lbs. of phosphoric acid represents about ·001 per cent. phosphoric acid in a soil of average quality and depth, which is contained about ten times over. The same remarks apply to the potash.

Other crops take from the soil:

Grass.—A crop of $1\frac{1}{2}$ tons of hay per acre—Nitrogen, 49lbs.; phosphoric acid, $12\frac{1}{2}$lbs.; potash, 51lbs.

Potatoes.—A crop of 6 tons per acre — Nitrogen, 67lbs.; phosphoric acid, 24lbs.; potash, 80lbs.

Turnips.—A crop of 17 tons per acre—Nitrogen, 112lbs.; phosphoric acid, 33lbs.; potash, 149lbs.; but are unable to make use of the phosphoric acid contained in the soil, and require especially phosphatic manures.

Mangels.—A crop of 22 tons per acre — Nitrogen, 147lbs.; phosphoric acid, 53lbs.; potash, 300lbs. They are deep feeders, and are capable of using the phosphoric acid and potash in the soil, but require plenty of nitrogenous manure.

Leguminous Crops (such as Beans).—A crop of 30 bushels beans and 2,200lbs. straw contain—Nitrogen, 106lbs.; phosphoric acid, 29lbs.; potash, 67lbs.

Red Clover.—A crop of 2 tons of hay per acre contains—Nitrogen, 102lbs.; phosphoric acid, 25lbs.; potash, 83½lbs. The plants have the power of absorbing their supplies of nitrogen from the air, and are not benefited in any way by the application of nitrogenous manures. These leguminous crops contain a large percentage of lime, and are specially benefited by the application of lime. The quantity of lime taken by the above-mentioned crops from the soil is—

Cereals	about	10lbs.
Grass	,,	32lbs.
Potatoes	,,	27lbs.
Turnips	,,	70lbs.
Mangels	,,	43lbs.
Beans	,,	29lbs.
Clover	,,	90lbs.

It is this power that the leguminous crops possess of extracting their nitrogen from the air that makes them of such especial value for ploughing in for green manure. Green manuring is the cheapest form in which nitrogen can be supplied to the ground. Crops such as cow-pea, clover, and soy beans are especially valuable for this purpose. By cultivating and ploughing into the ground a crop of cow-pea weighing 4,000lbs., or about 2 tons of pea straw and grain to the acre, we return to the soil about 106lbs. of nitrogen, which, purchased in the market at current rates, is equal to 5cwt. of sulphate of ammonia at 18s. per cwt., or £4 10s., without taking into consideration the benefit derived from the humus ploughed into the soil. An article on the cultivation of the cow-pea was published in the last issue of this journal, in which the advantages of green manuring were commented on.

NOTICE TO SUBSCRIBERS.

Subscriptions for the year 1902 are now due, and must be paid on or before 1st February, 1902, otherwise names will be struck off the lists.

COOL FERMENTATION.

A. Despeissis.

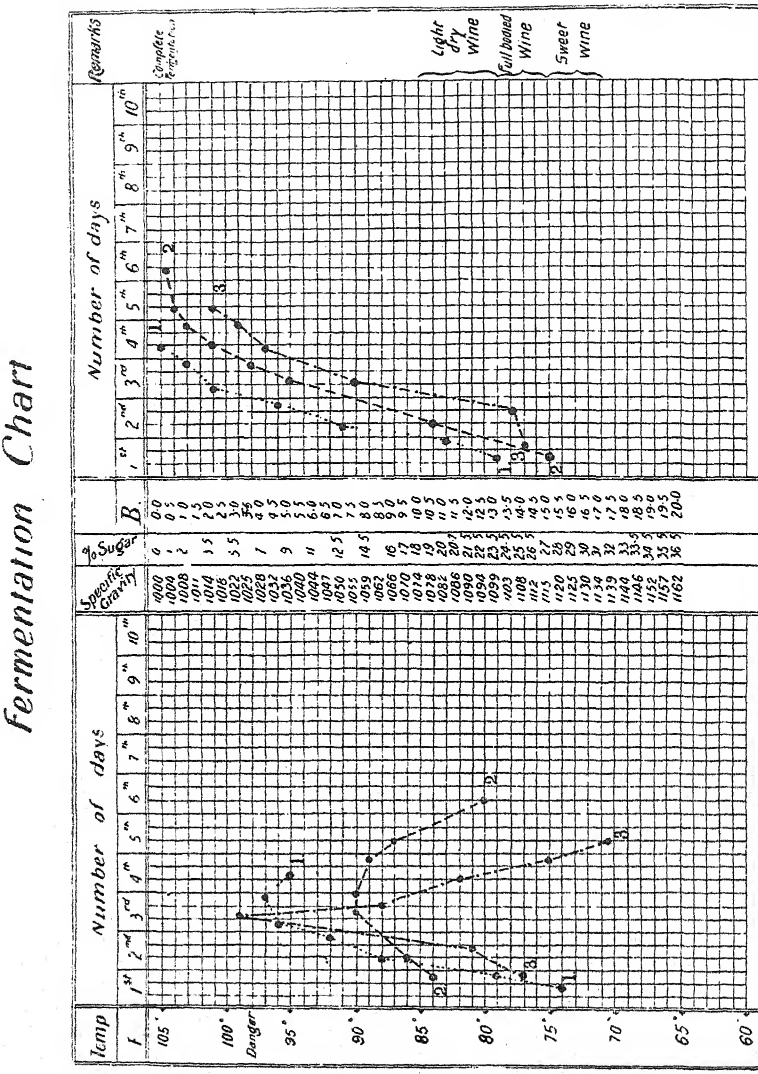
Fermentation, it has been long acknowledged, has hitherto not received at the hands of many winemakers the amount of care and attention it is entitled to.

It is recognised that all through Australia thousands of gallons of what should have turned out to be sound, marketable wine has been spoilt through defective fermentation. The conditions which favour it have, however, been thoroughly investigated. The requirements of the active agent of vinous fermentation—the yeast plant—are well understood. Temperature is, amongst other essential conditions, the one which influences it most, either for weal or for woe. A suitable degree of natural acidity of the juice of the grapes also helps to favour the yeast of vinous fermentation and to check the germs of diseases of wine. Unfortunately the same natural conditions which favour the luxuriant growth of the grape-vine in this country at times fail the winemaker when the grapes have reached the fermentation vat. Artificial means have in consequence to be resorted to in order to control the temperature and to correct the lack of natural acidity referred to. Like most artificial methods they need to be used with judgment, and winemakers are too often inclined to disregard them, and leave it to Nature to complete within the fermenting vat what it bountifully initiated within the grape-berry.

The use of attemporators or heat coolers have, under many hot climates, been used with most satisfactory results. Several designs have been contrived for that purpose, but they all entail a high initial cost, as well also as the necessity for a large supply of cool water, which has in the first instance to be secured, and subsequently has to be pumped up before it can be utilised.

The experiments I conducted during last vintage in order to control the vinous fermentation were, however, successfully carried out without the use of costly attemporators or of large quantities of cool water. From the Government Refrigerating Works I obtained a supply of ice sufficient for controlling the temperature in the fermenting vats under conditions which generally prevail at vintage time in our cellars. For that purpose, I arranged with some of our largest wine-makers to conduct a set of experiments which have turned out as successfully as I anticipated. The experiments were conducted at three of the largest fermenting sheds on the Swan, to which ice could with little loss in transit be promptly conveyed, viz., at "Houghton," at "St. Leonards," and at "Santa Rosa."

The following fermenting chart illustrates the progress of fermentation under circumstances which I shall briefly explain :—



In order to further assist the yeast germs, the grape must, subjected to the cooling effect of the ice, received an addition of 2oz. to 3oz. of tartaric acid for every 100 gallons. No. 1 diagram illustrates the course of fermentation in a vatting of Malbec previous to the date when ice was used at all. Such

defective fermentations are more the rule than the exception at many of our vineyards. The temperature in three days rose up to 97 degrees, a degree of heat which is prejudicial to a healthy fermentation. Concurrently with this rapid rise of the temperature, the attenuation of the must, or, in other words, the conversion of the grape sugar into alcohol, was speedily completed, although the must originally contained as much as 23·5 per cent. of sugar. It was sheer luck that fermentation was completed without the vat getting "stuck" before all the sugar had been converted into alcohol. Such wine, although sound now, must have been robbed of much of its delicacy and of these wine ethers which produce the much-prized "bouquet."

No. 3 represents a fermentation of 2 tons 5cwt. of Shiraz grapes. The timely use of ice here averted a disastrous fermentation. In two and a-half days the temperature jumped from 77 deg. F. to 99 deg. F., when 85lbs. of ice were placed in the coolers on the 17th of February in the morning, and the temperature was in a few hours brought down to 88 deg. F. It is well to explain that the optimum, or the most suitable degree of temperature for the yeast germs of vinous fermentation, ranges between 80 deg. to 90 deg. F. Below 80 deg. fermentation is sluggish, and the yeast germs work slowly; above 90 deg. F. fermentation becomes for a time tumultuous, until as the heat increases and gets nearer 100 deg., when the yeast germs by degrees become paralysed and soon die, unless prompt relief is brought to them and the degree of heat reduced. When that higher temperature is reached, latent germs of diseases, such as the mannitic ferment, which produces *sour-sweet* wine, as well as other germs of maladies of wine, take possession of the fermenting mass, and in a short period spoil the wine.

In the instance under review the dangerous zone of temperature was soon reached and as quickly reduced, and although the fermenting mass was only subjected for a very few hours to a temperature ranging over 95 deg., the evil effect soon became apparent, and had not ice been timely applied, over 200 gallons of wine would have been irremediably lost. On the fifth day, the new wine was drawn into clean, cool casks, and still contained as much as 3·5 per cent. of grape sugar. Owing to the timely application of the ice, fermentation shortly afterwards started again, and the wine is now dry and sound.

No. 2 chart illustrates a healthy fermentation, and, with proper care, the resulting wine should exhibit all the qualities which are prized in good wines.

The grapes are the choicests sorts used in wine making, and are such as produce the celebrated Medoc and Hermitage wines of France. They were picked before they became over-ripe. A small quantity of tartaric acid was added to the must to further help the yeast plants in converting the grape sugar in the must into wholesome alcohol in the wine.

The fermentation lasted six days, and the temperature was maintained below 90 degrees F. The cap, made of skins and seeds,

was kept submerged in the vat by means of a false head, and was not, as is often done, poked down three or four times a day into the liquid below. The result is a wine which is completely fermented: that is to say, a wine which does not contain any appreciable amount of grape sugar left. It is, moreover, lighter in colour than wines fermented at a high temperature, and which had a floating cap repeatedly pushed down into it. It is not so harsh to the palate, and does not contain any excessive proportion of extracted matters. It has, moreover, cleared in the cask, and already looks less turbid and more forward than wine from other vattings fermented at a higher temperature and without the cooling assistance of ice.

The ice used was valued at 5s. the 2cwt. block, and if taken in larger quantities where provision is made for its safe storing, it could be supplied at a smaller cost. With railway freight added, it cost about 3s. a cwt. The amount of ice used varied from 30lbs. to 85lbs. per vatting of 200 to 350 gallons of must in fermentation. A liberal computation would be half a cwt. per vatting of 250 gallons of must, or less than one-twelfth of 1d. per gallon of wine made. The ice was sawn into blocks which would fit into empty kerosene tins. These tins were provided with a wire handle, for convenience of handling, and weighted with bricks on top of the ice, so that they sink to two-thirds of their height into the fermenting mass, and rest over the perforated false head which keeps the cap down.

The ice melts more or less quickly according to the degree of heat in the must, and as the upper layer of the liquid in the vat is cooled, the hotter layer underneath should be run into a tub by opening the cock at the bottom of the vat, and either pumped or bucketed back on to the top of the fermenting liquid. This equalises the temperature all through the mass, and allows fermentation to proceed without hindrance.

Considering the success which has attended these experiments, and the mere nominal cost at per gallon of wine made, the Department of Agriculture will, on application, assist those wine-makers who are not too far from a railway station by supplying them during the period of vintage from the Government Refrigerating Works, and at a price which will cover cost of making the necessary amount of ice for the purpose of controlling the temperature during fermentation.

The ice is forwarded by rail, wrapped in bagging, and wine-makers should make arrangements for taking prompt delivery at their nearest railway station and conveying the ice to their cellars with least possible delay. On taking delivery, the block of ice could be wrapped up in a blanket and transferred on arrival to an ice chest. Such a chest can readily be constructed by anyone who can use tools. It really consists of two boxes, viz., a smaller one inside a larger, with a 4 to 5 inch interval between their sides. In that interval cork grit, which can be procured from wholesale importing druggists or from cork merchants, is packed; failing cork grit, sawdust can be used for the purpose of acting as an insulating

material. The inner box should be tin-lined, and should have a small pipe drain at the bottom to take the melted ice away. A double lid completes the construction of this ice-storing receptacle.

During vintage my services are at all times at the disposal of winemakers, and whenever called to give any assistance in directing them, either at the cellar or at the vineyard, I shall endeavour to meet them when required.

PUMPKINS.

By Herbert J. Rumsey, in the *Australian Vigneron.*

It is very convenient to have a nice stock of pumpkins to start the winter with, and it is astonishing what a quantity can be obtained from a very small plot of ground judiciously fertilised.

The pumpkin, when analysed, is found to consist of 92 per cent. water, which means that 1cwt. of pumpkins contains only 8lbs. of solid matter, and of this not much more than a quarter of a lb. consists of elements that are not plentiful in every soil. Of this phosphoric acid is the largest part, while nitrogen comes next, followed by potash. By taking note of this we may get an idea of the requirements of the crop—(1) A soil that will naturally hold a large quantity of moisture. We must not infer a wet soil from that; on the contrary, we require a well-drained one, for it is not the actual pools of water that the plants use, but the large amount left in suspension in the soil after the surplus of water is drained off. The largest crop of pumpkins I ever saw was on a piece of ground that had been a swamp, but was then drained by a large channel six feet deep. The black swamp soil, full of organic matter, and helped by a dressing of bone refuse from a sheep boiling-down works, was just what they wanted. The ground was actually covered by the crop when the vines died away. But as a rule, at any rate, when growing for home use, we have to take the garden just as it is, and grow the best crop we can in it. In that case prepare the pumpkin bed by digging in all the manure available. Never mind if it is old and exhausted; it will help to retain the moisture. Add a little complete fertiliser, or a mixture of bones, blood, and potash to each hill; put a group of seeds to each hill, about six feet apart. By hill I do not mean that it should be raised much above the level of the bed, for the nearer we get to flat culture the less we lose by evaporation. When the plants are well up, thin to four at each hill, and when they have obtained the second lot of leaves, then again to two. Keep all weeds down until the vines cover the ground. If the tips of the shoots are cut off when they get three or four feet long, they will branch, and get fruit closer to the roots.

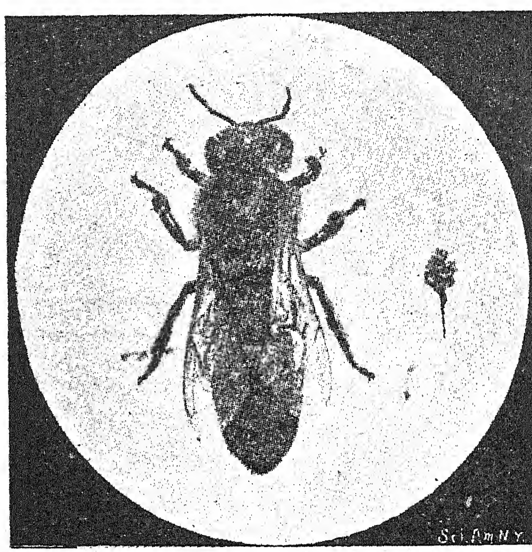
BEE-KEEPING IN THE UNITED STATES.

By Waldon Fawcett.

(*Scientific American*, November 2, 1901.)

The general public is prone to think of bee-keeping merely as an adjunct of agricultural operations, but in reality it has attained, during the past few years, to the position of a very important American industry. Extensive apiaries have been established, and thousands of persons in various parts of the country are devoting their entire time to the scientific fostering of honey production.

Something of the scope of the operations now being carried on may be imagined from the fact that there are now in the United States considerably over one hundred apiarian societies, eight periodicals published solely in the interests of the industry, and fifteen steam factories for the manufacture of beehives and apiarian implements.



Working Bee and Sting.

It is estimated that there are fully three hundred thousand (300,000) persons engaged in the culture of bees in this country at the present time. In the absence of any method of securing official statistics from year to year, many estimates have been made of the quantity of honey produced annually on this side of the Atlantic, and though the figures presented have invariably seemed ex-

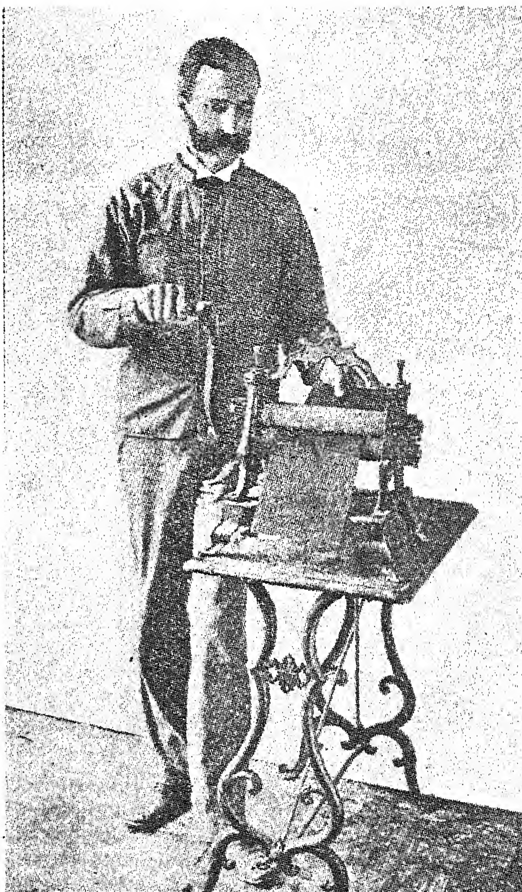
travagant to the uninitiated, the statements, there is every reason to believe, have been without exception highly conservative. Prominent bee-keepers who undertook a year or two ago to form some idea of how much honey is produced in the country came to the conclusion that at least fifty thousand (50,000) pounds is stored in sections every year, while they assumed that one hundred thousand (100,000) pounds of extracted honey is produced—an aggregate of one hundred and fifty thousand (150,000) pounds. The bee-keepers, however, were probably too modest in their claims, for their calculations showed the annual honey crop of the country to be worth $10,000,000, whereas the officials of the United States Department of Agriculture, who have made an especial study of the subject, place the valuation at fully double that figure.

This record of the great wealth represented in a comparatively obscure food product is all the more remarkable when it is remembered that the apiarian industry in the United States is practically a development of the last forty years; although isolated individuals were engaged in the work long prior to that time. In the score of years from 1869 to 1889 the American production of honey was quadrupled, increasing from less than fifteen million (15,000,000) pounds annually to nearly sixty-four million (64,000,000) pounds annually, and the closing decade of the century witnessed a growth proportionately greater, since the estimated output of the closing year of the cycle, as given above, is very much more than double that recorded ten years ago. The bee-keeping industry, however, far from having reached the acme of possible development, would appear to be only just entering upon an era of even more remarkable growth, and it is estimated by the authorities of the apiarian world, that the present existing flora of the United States could undoubtedly support, with the same average profit, ten times the number of colonies of bees now to be found in the land.

The bee family is made up of several distinct types, including the hive bee, bumble bee, carpenter bee, leaf cutter, and the stingless honey bee of the American tropics. Strictly speaking, the apiarian industry concerns itself only with the hive bee, although the plan of introducing the stingless bee from tropical America has frequently been considered. It is admitted that this latter class of insects might be kept in the warmer parts of the country, but the fact that their honey yield is small and not easily harvested, makes it problematical whether the attempt is justifiable. Passing by the varieties of hive bees, which are natives of Asia and Africa, we find in America at the present time, a variety of distinct bee families.

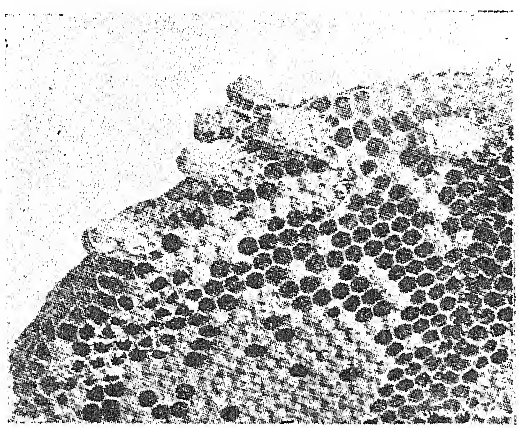
The common brown or German bee was imported from Europe during the seventeenth (17th) century, and is now to be found in every section of the Union, from the Atlantic to the Pacific. Other races, all introduced during the last half-century, include the Egyptian, Italian, Cyprian, Syrian, the Palestine, the Carniolan, and the Tunisian. Almost all of these races have become to a greater or less extent hybridised with the brown or German race.

Each colony of bees in good condition at the opening of a season contains a laying queen and some thirty thousand to forty thousand (30,000 to 40,000) worker bees, or six to eight quarts by measurement. It is quite possible, too, that several hundred drones may be included in such an assemblage. Under normal conditions the queen lays all of the eggs which are deposited in the hive, being capable of depositing as many as four thousand (4,000) in a day. Upon the workers or females devolves all the labour of gathering honey, secreting wax, and building combs. The drones or males are not a factor, save in contributing somewhat to the general warmth of the hive, necessary to the development of the brood.



Making comb foundation.

The food of honey bees is found in pollen and honey. Pollen, the fertilising dust of flowers, is carried home by the bees in small pellets, held in basket-like depressions on each of the hind legs. The liquid secreted in the nectaries of flowers is usually quite thin; much of the water which it contains must be eliminated either during the transportation of the nectar to the hive or after it has been stored temporarily in open cells. To transform this nectar with its raw, rank taste into the greatest of table luxuries is one of the chief functions of the worker bees. Workers are stationed in lines near the hive entrances, and by incessant buzzing of their wings drive currents of air into and out of the hive and over the comb surface. The loud buzzing of the bees frequently heard in the vicinity of a hive at night is due to the action of the wings of the little workers engaged in ripening nectar. When a considerable portion of the water has been eliminated and the disagreeable odour and flavour driven off, the finished product is stored in waxen cells, and seals in the form of waxen caps are speedily put in place.

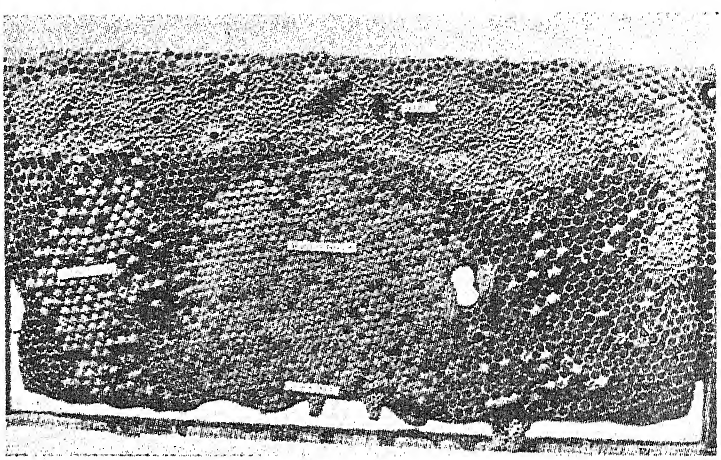


Cluster of Queen cells.

The successful manipulation of bees is one of the most delicate of tasks, and requires skill and experience. A majority of professional bee manipulators in time grow somewhat indifferent to stings, since they become so thoroughly inoculated with the poison of the bee that the pain of the sting is less severe and the swelling slight. Moreover with a number of the races of bees recently introduced into this country, the avoidance of stings is simply a question of care in the manipulation of the insects, combined with a free use of smoke. Even in utilising this latter safeguard, however, care must be exercised, for the idea is to simply alarm and subjugate the bees with the smoke and not to stupify them. The time usually selected by expert bee-growers for the manipulation of swarms is when most of the bees are busy in the fields. The young bees left at home are most easily controlled, and the old ones upon

their return are, as a rule, heavily laden with the fruits of their foraging expedition.

Apiaries may, of course, be established at almost any season of the year, but the spring is decidedly the most favourable time, and that usually selected. Bee masters usually sell colonies of pure Italian or Carniolan bees in securely constructed hives at prices ranging from six to eight dollars a colony. The bee-keeper needs but few implements if he has a comparatively limited number of hives; his aggregate expense need not exceed six dollars, the sum necessary for the purchase of a smoker, a wax-extractor, and a few Queen-introducing cages. To secure the best results, it is necessary to have constructed hives that are not only adapted to the nature of the bees, but also to the climate of that particular locality. The hives must be so constructed, also, that while able to retain the warmth of the bees in out-door wintering, and keep the rain from beating in, they still provide for the escape of moisture. Dozens of labour-saving devices have within the last few years been introduced into the apiarian world, and bees are now given artificial outlines of cells as a basis for court building.



Drones. Workers. Honey.
Queen Cells.

Frame of comb from the brood nest of a colony that has recently cast a swarm.

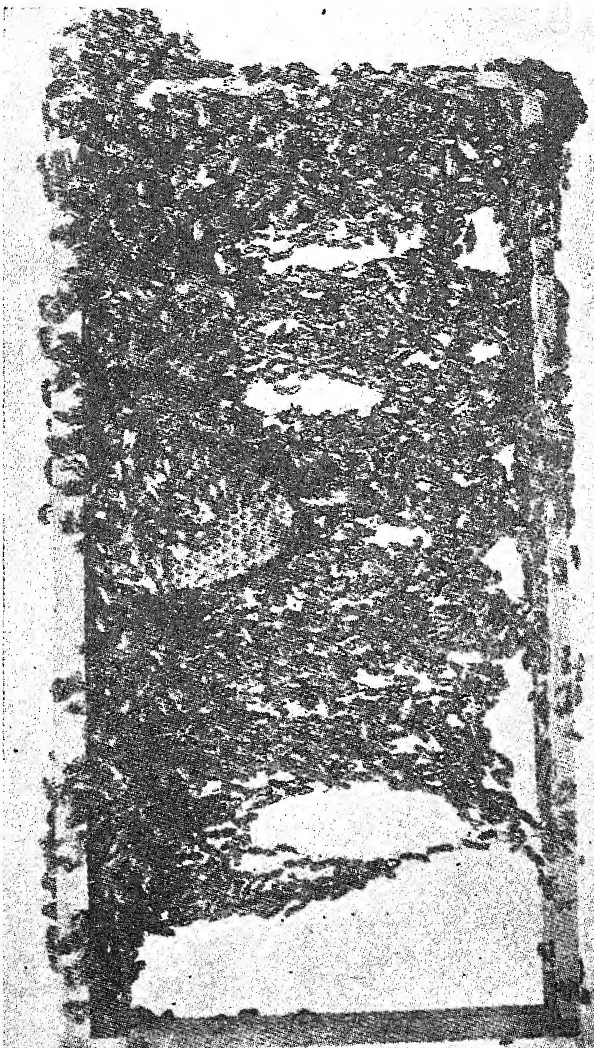
The process of extracting honey is another operation wherein care is necessary. The filled combs, as fast as removed from the hives, are placed in a light case the size of a hive, or a tin can made especially for the purpose, covered closely to prevent the access of robber bees, and taken to the extracting room which is bee proof. The uncapping knife, held in hot water when not in use, is passed rapidly under the capping of the sealed combs, the point of it being used to reach depressed surfaces, the loosened cappings

drop into a sieve resting over a pan, or into the upper part of a can especially designed to receive cappings. The small amount of honey removed with the cappings drains through the strainer and is drawn off below. The uncapped combs are placed in the extractor at once. In this branch of honey capture three persons usually work together—one removing the surplus cases or combs from the hives, freeing them of their bees and bringing them into the extracting room where two assistants uncap and extract the honey. The honey extractor itself consists of a large can within which a light metal basket revolves. The full combs of honey from which, as explained, the cappings of the cells have been removed are placed inside the basket, and after several rapid revolutions by means of a simple gearing are found to have been emptied of their contents. The combs, only very slightly damaged, can then be returned to the hives to be refilled by the bees. If extra sets of combs are at hand to supply as rapidly as the bees need the room in which to store honey, great yields can often be obtained.

The progressive present-day apiarist does not look for the production of wax in so great a proportion, compared with his honey yield, as did the old time box-hive beekeeper. The latter obtained much of his honey for the market by crushing the combs and straining it out leaving the crushed combs to be melted up for their wax. Frequent losses of bees in wintering and through queenlessness also gave more combs for melting, as without hive frames, honey extractors, comb foundation machines, and the other new modern devices, the vacated combs were seldom used a second time. The wax from the pressed combs was all marketed, since there could be but little home use for it.

The bee-keepers of to-day, however, as has been noted, after having removed the honey from the combs by centrifugal force, return them but slightly injured to be refilled by the bees, and at the end of the season these combs are stored away for successive years or else the surplus is marketed as stored, that is, without cutting. Now-a-days the only source of wax production is found in the cappings of the combs, occasional broken combs, etc. However, since the marketable price per pound of extracted honey is usually not less than one-third ($\frac{1}{3}$), and that of comb honey one-half ($\frac{1}{2}$) the price of wax, while it requires some 12 or 15 pounds of honey to produce one pound of comb, it may readily be appreciated that it is far more profitable to turn the working force, in so far as possible, to the production of honey instead of wax. Not only is there only such production of wax as may be secured, without lowering the yield of honey, but even what wax is taken is practically turned into honey the following year, for it is made into comb foundation which, judiciously used, increases in turn the season's yield of honey. Wax being so much more valuable than honey, it behoves the beekeeper to preserve even the smallest pieces of comb: the old way of rendering wax was to put the combs into a sack made of some open stuff, weight this down in a kettle of water and

boil for some time, the wax rose, and when cold was removed in a cake. The new approved plan of rendering is by means of the solar wax extractor. The machine is placed in a sunny spot and filled with wax cappings or bits of comb; as the direct rays of the sun strike it, the melted wax trickles through a strainer and collects in a tin placed at the lower edge of the tank or melter. The cake is removed each morning. When the solar apparatus is not available, wax is rendered by steam heat.



Comb builders hanging in clusters secreting wax.

HOUTMAN'S ABROLHOS.

By R. Helms.

(Read before the Mueller Botanic Society, 6th June, 1898.)

Reproduced from the *Producers' Gazette.*

Historical.

The low-lying archipelago known as Houtman's Abrolhos is situated between 28 degrees 15 minutes and 29 degrees southern latitude, and 113 degrees 35 minutes to 140 degrees 5 minutes longitude east of Greenwich, or approximately 40 miles west of Champion Bay. It is divided into three distinct groups—namely, the Wallabi Group in the north, the Easter Group, and the Pelsart Group in the south.

With the exception of North Island, and East and West Wallabi Islands, which rise from 40 to 50 feet above the sea and in part are composed of rocks found on the mainland, all the other islands are formed of raised coral, are almost level on top, and in no instance higher than 15 feet.

Submerged reefs connect the greater number of the islands, and fringing reefs encircle, more or less perfectly, the two southern groups. The Pelsart Group shows the best example of such a reef, and imparts to it the appearance of an atoll, for here a continuous reef leans on to Pelsart Island and extends in a hyperbolic direction for over 20 miles, with the apex towards the south.

Historically, these groups are closely associated with the early events of Western Australia; from a utilitarian point of view, they are of great value to the agriculturist and the fishing industry; and scientifically, they are specially interesting in more directions than one.

The historical part has frequently received attention by writers, and quite recently old memories have been revived by several leading journals published in Australia. Special mention deserves to be made of the *Western Mail*, because in its Christmas number of 1897 for the first time appeared a translation of the unique and authentic diary of Francis Pelsart, who commanded the ill-fated *Batavia* at the time of her disaster. Many other valuable vessels, whose commanders neglected to "keep eyes open," have since left their timbers on the treacherous semi-submerged reefs so abundant in these waters, but the wreck of the *Batavia*, being the first of them, and on account of the terrible atrocities which followed her misfortune, will for ever remain a conspicuous phase in the earliest history of our immediate neighbourhood, the details of which cannot be read without producing a shuddering sensation.

The advent of white men for the first time dwelling on Western Australian territory has been inaugurated by horrible barbarities, such as have scarcely ever been recorded of its aboriginal inhabitants, who are considered one of the lowest types of humanity, and who do not rise socially above the most abject savagedom. When reflecting upon these events one cannot help arriving at the conclusion that, in spite of the boast civilised man makes of standing above the animal and savage races of his own kindred, the animal within him is the more powerful characteristic, and that self-preservation underlies the greater number of his actions, and usually domineers above all better feelings in times of danger.

It must be admitted that the Dutch of the XVI. century were as advanced in civilisation as any other European nation, and, in fact, a highly cultured race; yet, under stress of circumstances, a number of these men, never before known to have done a bad deed, could easily be induced by a designing scoundrel to commit the most revolting crimes in the face of a probable famine ensuing if the whole band were to remain alive. The atrocities witnessed on the narrow space of these small islands and committed by the greater number of a community composed of cultured beings, who should have shrunk from the least injustice towards each other under the adversity of circumstances they had been placed in, were as terrible and disgusting, if not more so, than the worst deeds committed by savage cannibals.

The Economic Value of the Islands.

After this reference to a portion of past historic events, which gave these islands a weird notoriety, we will take a glance at the industries which during late years have made them quite famous, and promise to be augmented by others. For thousands of years the barren rocks have been the haunt of various species of sea birds, who visit them in countless numbers during the summer months for the purpose of breeding. Many leave for other regions when their offspring are strong enough to fly long distances, but they re-visit their accustomed nesting places the following year, whilst several species stay permanently at their sea-girthed homes.

On the greater number of the level low islands the accumulated droppings of the many birds have formed a valuable guano, which now supports a stunted vegetation where the deposit is deep enough to give the plants a foothold. In some of the hollows and depressions, which are always met with in coral formation, a depth of several feet is found, but the average thickness of the deposits varies from 6 to 30 inches on the different islands. Considering that in spite of the immense numbers of birds which regularly visit these old nesting places, the season's addition of excreta to the deposit is imperceptible, the growth of the guano stratum must have been very slow, and after the last ton has been removed it will take several thousand years before sufficient has accumulated to make it worth while to gather it again.

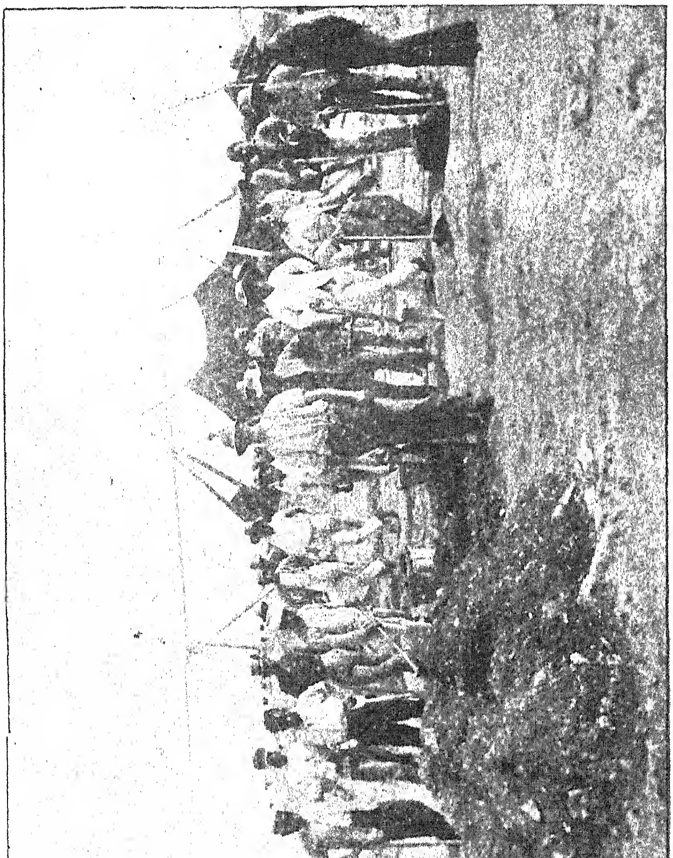
The guano of the Abrolhos is a greyish-brown odourless substance, containing a large amount of phosphates, varying from 50 per cent. to 80 per cent., or 60 per cent. on an average, which gives it a high value as a manure. Owing to the annually recurring rainfall, the fresh excreta has always given off its ammonia, and by this means become odourless. The absence of a pungent smell has somewhat prejudiced West Australian farmers against using this guano, because the greater number imagine that food for plants requires to smell offensively.

Since 1884 the firm of Broadhurst & McNeil have held a lease over the Abrolhos, and exploited these islands for the valuable guano. Up to date they have shipped 55,000 tons, for which a market has been found in several European countries, in Mauritius, the neighbouring colonies, and in Western Australia. The smallest consumption has been in Western Australia, but it is steadily increasing; and, according to information, the above firm estimates that the local requirements for 1899 will amount to over 1,500 tons. From the report on the deposits of the principal islands, furnished by A. J. Wells, L.S., I glean that 101,500 tons are still available.

In order to enable them to systematically work the deposits, Messrs. Broadhurst & McNeil have erected buildings and jetties on three islands—namely, on Rat Island in the Easter Group, and on Pelsart Island and Gun Island in the Pelsart Group. The building of the jetties and the erection of houses in these out-of-the-way places must have been a specially expensive undertaking. Besides these permanent works, which will almost lose their entire value when the islands have been worked out, several lighters and boats had to be provided, and for all this, together with other working plant, the capital sunk in the enterprise amounts to over £10,000.

For collecting the guano and for working the boats, from 40 to 50 men are employed. Some 30 of these are Malays, who are mainly engaged in collecting the guano. Although this work is easy and in no way unpleasant, it appears that Europeans do not care much for it, and as a rule never remain long at the islands, and often leave at an inconvenient time to their employers. To keep the concern going, the firm has been compelled to employ Malays under contract for two years, although these people are not as good labourers as Europeans, even at such easy work as scooping guano together, for they take matters as phlegmatically as possible and never hurry themselves over it, and at the same time they take advantage of the slightest deviation from the contracted stipulation to shirk work altogether. One of the points of agreement is that they shall have an abundant quantity of rice daily, and when during my visit the prevailing westerly winds prevented the schooner from leaving Champion Bay for a week, rice ran out, the work immediately ceased. The strikers declared that they could not work without rice, the other food—consisting of meat, fish, potatoes, and bread, etc., of which there was plenty—not being strong enough. It will be

seen from this that labour troubles may occur even at the most out-of-the-way places.



Group of Malays with their European Foreman.

The collecting of the guano is very simple work. After the stunted growth has been removed, the stuff is shovelled together and with hoes scraped out of the pockets and hollows found in the rock, which are finally swept with stiff brooms. It contains but little moisture during the summer when *in situ*, which, after being disturbed, soon leaves it almost entirely. Later the dried guano is thrown over screens to free it from roots and stones, which operation has to be done behind a wind-break made of canvas, in order to prevent large quantities of the light stuff being swept into the sea. The fine guano is put into bags and conveyed on trucks running on light rails to the jetties. From here it is shipped in crafts with a shallow draught to the larger vessels, which have to lie off a few

miles in one of the many channels, where enough water may be found to float the largest vessel.

Owing to the total absence of fresh water on the greater number of the islands, and because not sufficient rain water can be gathered from the roofs of the buildings to provide the workmen with it for more than a few months after the rainy reason is over, a small schooner has to be employed at regular intervals during the dry season for carrying water from Champion Bay. During the summer months the communication with the islands is therefore almost regular, and unless the wind is adverse the Abrolhos may be reached weekly in a comfortable little schooner.

As might be expected from the nature of the shallow sea in the neighbourhood of the reefs, and the food abounding therein, some excellent fishing grounds occur in many localities. This is specially the case in the inner margins of reefs where these are dissected by channels, and on certain shoals where currents meet. These opportunities for harvesting the living wealth of the ocean are taken advantage of by upwards of a dozen parties of fishermen, who, with boats adapted for the purpose, pay regular visits to these places as long as the weather permits it. The fishing industry is at present very remunerative to those engaged in it, on account of the market on the goldfields, where large quantities are sent, packed in ice.

In years to come the fishing industry promises to expand considerably, and to become, under better arrangements, a more profitable pursuit than it is already at present.

The export of eggs from these islands during the laying season would also be a lucrative venture. From at least three kinds of birds they can be obtained with ease and in abundance during ten weeks at the proper time of the year, and, what is important, they furnish excellent food, because tern and mutton birds' eggs are, in purity of flavour, equal to the best of fowls' eggs.

Before concluding this part of our discourse, I must mention another industry which may have a great future, namely, the culture of oysters and pearl shells. Saville Kent, who, as we know, visited these islands and reefs, was so impressed with the suitability of the localities for these purposes that he has lately applied to the West Australian Government for some concessions, and is forming a company with the view of taking the matter systematically in hand. Splendid oysters occur now in places, especially in the Wallabi Group, but they are somewhat difficult to gather, consequently not often brought into market. The Sharks Bay pearl shell, *Meleagrina imbricata*, occurs already in these waters, but the submerged reefs and the lagoons are considered to be well adapted for the culture of *Meleagrina margaritifera*, the large species found further north.

Having alluded to the utilitarian value of these rocky islets and their surroundings, I come to the interesting aspect under which a scientist views this portion of the globe; and although fearing that I will not be able to do the subject full justice, I shall, in saying

something regarding its formation and about its flora and fauna, endeavour to bring at least the more striking features under your notice.

Physiography.

Anyone who has seen the excavations on the railway line between Perth and Fremantle does not require to be a geologist to gain the conviction that the prevalent limestone formation is due mainly to coral growth. Wherever the sand has been removed from the surface of the rock, the cores of coral clusters stand forth like pinnacles of abraded stalagmites, or, as it were, like trunks of trees denuded of their branches, alternating with hollows and ridges. The overlying stratum of sand, which unquestionably is of æolian origin, has protected the coral pillars from denudation, which otherwise must have taken place, and as is the case on elevated positions where the limestone has been exposed. I mention the peculiarity of the sandfreed surfaces not so much on account of their rare and almost unique appearance, as with the object of showing that scarcely anything could more strikingly amplify their origin.

When corals in our seas could grow in such a luxuriant manner as to cover large areas with the huge deposits we can everywhere observe in close proximity to our domicile, as well as along the whole coast and beyond the southern extremities of Australia, the climate must have been much warmer than it is at present in our latitude, and then the shores of our continent were evidently washed by a tepid ocean. It is assumed by all geologists that during the eocene period the temperature of the earth must have been more uniformly warm and altogether higher than at present, and in our latitude at this time was probably greater than it is to-day in the tropics. Through succeeding periods, which are not sharply limited, as in Nature no sudden changes of any magnitude occur, the climate grew cooler from the poles towards the equator, and the more sensative marine life became extinct in a degree as the ocean's temperature became lower in consequence of this change of climate.

The massive monument left some hundreds of thousands of years ago by millions upon millions of active polypes in the place upon a portion of which we stand at present, which then, just as they do now further towards the equator, extracted and consolidated the lime from the ever-moving ocean to build their solid or delicate but always grotesque dwellings, materially adds to the evidence that Nature works very uniformly under even conditions.

It is highly probable that the elevated islets and the greater portion of the submerged reefs constituting Houtman's Abrolhos belong to the same formation that furnished the material for the Fremantle Harbour Works; but the reefs surrounding them are still forming. This feature conveys special interest to the locality, because here occurs, so to say, a transition from bygone times into the still living. Moreover, the Pelsart Group marks the southernmost limit at which reef-building coral-polypes at present exist. The curve made by the reef fringing the Pelsart Group extends but

slightly beyond the 29th deg. of southern latitude, and nowhere else in the southern hemisphere do living coral reefs occur at that parallel. In the northern hemisphere living reef-forming corals are found as far north as 32° 15′, namely round the Bermuda Islands, which is their limit of extent towards the north, their occurrence here being attributed to the warm currents of the Gulf Stream. With the exception of these two outposts and a few other isolated positions, the area of coral reefs is limited between the 24th deg. to the north and 26th deg. to the south of the equator.

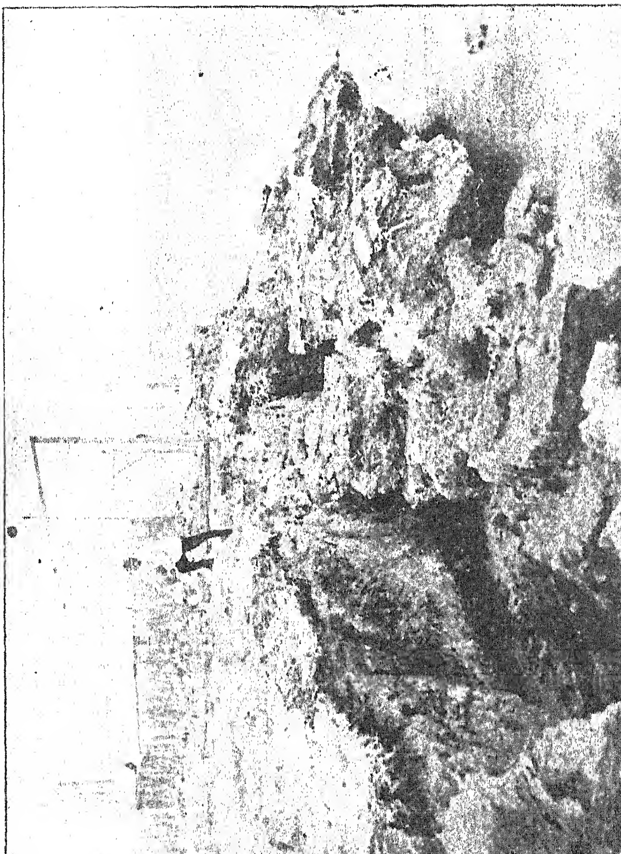
From the shallow sea intervening between the mainland and the Abrolhos, it is evident that formerly both approached closer towards each other, or were altogether connected; which is further supported by the fact that portions of the rock formation on the Wallabi Islands are non-coraline, and identical with those of the mainland, and by the existence of wallabies and other animals, which could not possibly have crossed 35 miles of sea.

The greatest depth between the mainland and the islands is 30 fathoms, and on an average about 22, whilst to the west of the group the sea rapidly deepens to beyond 100 fathoms.

As previously observed, the reefs surrounding Pelsart and Easter groups give them the appearance of atolls, but the submerged reefs connecting many of the islands, and extending under shallow water to the outer reefs, prove these to be fringing reefs which, since the elevation of the islets and their environment, have expanded. There is nothing remarkable about this formation as a whole, except the shape of the greater number of the islands. These are more or less eroded at the base, and have overhanging shelves several feet in thickness on top, varying according to the elevation of the whole. The erosion has been caused mainly by the swell of the tide, sometimes strengthened by winds, but not by the lashing of tempest-stirred breakers. Had they been regularly exposed to the full brunt of breakers or the fury of an excited ocean, the erosion could not have gone on in the manner exhibited, for the waves would have risen above the rims of the islands and taken away more from the top than the base. The consequence of such action would have been a gradually rising beach rather than a basal erosion with overhanging shelves.

To account for the existing peculiar features, a more or less vertical escarpment is required in the first instance. It is inconceivable that these islets could have been elevated suddenly with vertical walls, and therefore the whole area of the groups must have risen more or less above the sea when the portion between it and the present shore subsided. During the elevation, which, it must be remembered, has been steady and, may be, imperceptibly slow, vertical fissures appeared in the formation where the tension was greatest, and this, with the continuous subsidence and a simultaneous rise in other parts, will account for the characteristic features the islands now present.

What I have attempted to explain as having taken place in ages past and in a larger measure, repeats itself, or at least is exemplified in miniature around the islets at the present time. In a number of places the overhanging shelves have broken off, and the detached rock lies at the base or rests slantingly against the escarp-



Portion of Gun Island, illustrating the fractures of overhanging shelves.

ment, and in this manner the fractures represent the fissures, and the detached rocks the subsided formation. It is not an exact comparison, for the rupture and detachment of the rock have been rather sudden, owing to the space produced by erosion below it; but the juxtaposition and appearance is so similar that, in order to conceive the working of natural laws on a larger scale, one requires merely to substitute subsidence for erosion and banish the idea of suddenness from one's mind.

On a few low-lying islets in the southern groups situated near the deeper channels, and exposed to the direct wash of the ocean, sandy

beaches occur. In the Wallabi Group they appear more frequently, and there, on North Island, a dune encircling the whole area rises between 20 to 40 feet from the beach, whilst the interior is level and only a few feet above the sea. With this exception, sandy beaches are the least characteristic features in the archipelago, and do not extensively contribute to the formation of land. Much solid ground, however, is added by dead coral. Large and small fragments of living coral are constantly being detached by the waves from the outer margin of the reefs, and especially so during heavy weather, which, being washed over them, help to enlarge these on the inner side; or they are piled up on low islets and semi-submerged reefs, are consolidated into compact rock in these places, or, may be, moved off again to more sheltered situations.

On Pelsart Island the narrow northern extension is entirely formed of dead coral resting on a solid foundation, and is constantly being added to. This portion, therefore, differs in its structure from the southern part, which belongs to the previously-described type of islands, although the characteristic shape of these is here somewhat obscured through being in part exposed to the open sea. Pelsart Island, as mentioned in the outset, is placed in direct connection with the large outer reef which encloses the group named after that island, and thus it has to bear on one side the brunt of the south-eastern gales.

These gales are responsible for large quantities of coral detritus and dead shells being washed against its shore; here these masses are alternatively heaped up and swept away again to be ultimately piled up on the northern extension. The six to seven miles long shore of this part, in consequence of the heavy wash, is more or less sloping below, and towards the crest is overlaid with ridges of loose coral, which underneath becomes solidified by degrees through percolation.

The study of the Abrolhos offer many more interesting facts connected with coral-reef formation, but the more salient points having been noted, we will proceed to discuss the other subjects of natural history.

The Flora.

In shallow water, where moderate currents prevail, the bottom is in places covered with different species of seaweeds, which, plainly seen through the clear fluid when the surface is not ruffled by the oars, produce by their fresh colours an exhilarating sight. It becomes very attractive, when leaning over the side of a drifting boat, to watch the gently-moving blades of the algæ bunches, interspersed with coral and other growth, and observe fish darting from under them, and other marine life moving over the reefy bottom. A considerable collection of algæ could no doubt be made in these waters and on some of the shores, where occasionally large quantities get piled up after strong winds.

Regarding the terrestrial flora, the season was too far advanced to allow a detailed conception of it being obtained. Everything,

except the salinacious plants and a few other species, was withered up, and this could hardly be expected otherwise, considering the shallowness of the soil. But so much could be seen that on the whole it is very poor in species, and that among them there are none specially indigenous to the islands. Only one species, a *Trithema*, found abundantly on Rat Island, I have not met elsewhere, but I have no doubt that it occurs in other places also. *Nitraria Schoberi*, which is a littoral plant yielding an edible berry, was very common on most of the islands; and on Gun Island, for example, fringed the north and western side entirely. Wooded Island, in the Easter Group, derives its name from the mangroves found there; and on Pelsart Island several copses of old trees of the same species are growing, many with stems over a foot in diameter, and upwards of 15 feet high, which are the largest specimens of vegetation to be met with; every other scrub is small and stunted, except on some parts of the Wallabi Islands, where the deeper soil is conducive to a vigorous growth, and then the brush becomes tall and dense.

Two species of saltbush are common everywhere, and predominate over the whole area on the guano deposits to such an extent that where the surface is still undisturbed other plants are, so to say, merely scattered among them. *Salicornia* (the false samphire) and *Mesembrianthemum* are found on all the larger islands. On Middle Island, the largest except Pelsart Island, in the southern group, which, strange to say, is not visited by many birds, and has no deposit of guano upon it, I found *Sarcostemma Australe* fairly abundant and also a *Myoporum* and an *Eremophila*. The latter species was also met with on Gun Island and on Pelsart Island.

Several exotics have found their way to the islands which are being worked for guano. No doubt the seeds of these were brought there mainly with chaff, as a horse is kept for pulling the trucks. The commonest of the introductions is the sow thistle (*Sonchus oleraceus*), which was also noticed on several of the smaller islands, where the seeds have evidently been carried by the wind. *Sonchus arvensis* was also seen here and there, and the spurry (*Spergula arvensis*) quite commonly. On Rat Island the nettle-leaved goosefoot (*Chenopodium murale*) has spread to every available part. It seems that Europeans, wherever they may go, are followed by noxious animals and weeds.

Marine Life.

In coming to the discussion of the animal kingdom, the coral polypes claim our attention in the first instance, being the most numerous and having left such colossal evidences of their presence through bygone epochs. They stand very low in the scale of animated nature, and by their life history one is reminded as much of a plant as of an animal, because they possess the appearance of both. Their chief characteristic manifests itself in being a compound animal, meaning that the single individuals are not quite independent, but connected to each other and able to feed conjointly, and in this

manner they may be compared to branches of a tree, and although feeding in the manner of animals by swallowing their food they are, like plants, tied to their habitat and lack perfectly independent motion.

An orifice which serves for feeding as well as for the rejection of refuse leads to an expanded sac, which, answering to the stomach of the higher animals (because here the nutrient substances are separated from the refuse), is at the base connected by a duct or root-like process to that of the neighbouring individuals.

Round the mouth radiating tentacles are situated, which serve to arrest the nutriment floating in the water. The number of these tentacles vary in the different species, are variously coloured with them, and somewhat fold together when the animal contracts into the tubular pore it inhabits. The body is composed of several membraneous layers, from the cells of the outer one the carbonate of lime is secreted that forms the framework of their habitation.

Their production is by ova from which ciliated larvæ are born, which in this state possess a completely free motion. The individuals are sexually different, although hermophrodites also occur, and in a few cases the species are entirely hermophroditic. But the more prevalent mode of reproduction is by gemmation or budding, which, as the term implies, is by one individual growing out of another in the manner of a branch from a tree. By fissiparation the individual may be thrown off from the colony and then become the nucleus of another colony. It must be understood that a coral stock is not all one colony, but generally includes a great many.

The colour of the upper part of the body, and mainly that of the tentacles, impart the exquisite tint to the living corals. The most diverse shades, from brown and yellow to pink, rose, lavender, and purple, are displayed over the variable growths, and form a veritable flower garden below the water. Among the very characteristic and best known *Madreporæ* or "staghorn" corals bluish and purplish colours prevail, whilst *Meandrinæ* or "brain" corals are generally yellowish or brownish. The skeleton, or what is commonly known as coral, consists of carbonate of lime, and is quite white with the reef-building and other true corals, except in rare cases, among which the beautiful pink coral of the Mediterranean Ocean is the best known, because it furnishes such charming material for pretty ornaments.

It would require several weeks of special attention to find all the species that may occur on the Abrolhos, which seem to me, although from their geographical position against my expectation, exceptionally favourably situated for their growth, as the luxuriant production of several species of staghorn and brain corals are indisputable evidence, of which probably none larger could be found in the tropics. But one can see a great deal by walking at ebbtide over the dry reef, which is from a quarter to half a mile wide and almost level on top, with a very gentle slope inwardly. There are a number of hollows and depressions of various sizes and depths

found upon it, teeming with life of every description common to the ocean. These pools afford better opportunities for the study of marine life than most other places, and here in the placid and transparent water the beauty of the corals can readily be observed, although one does not meet with such large stocks as in deeper water and at the margins of the reef, where they are continuously swept over by the never-resting waves.

As, however, for three parts of the day the waves are forced over the outer margin of the reef, and by their wash, flowing inwardly, these pools are supplied with a current of water at regular intervals at the period of half-tide, and because at high water the whole reef is covered several feet deep, plenty of food reaches them, and it is evidently not for the lack of it that the corals do not thrive so well in these pools; but their lesser growth may probably be accounted for by the greater shelter they offer to their enemies. The shelter from a rough wash, combined with a regular renovation of the water, must be conducive to the development of a varied representation of marine life, which is borne out by the abundance met within their limits. Sea anemones, ascidians, crabs of all descriptions, including the large edible crayfish and prawns, and many species of "hermit" crabs, which occupy dead shells, starfish, sea urchins, holothurias, shells, and fishes, may be found in the greater number. The life is so multifarious, vari-coloured and interesting in these pools that it would take me hours if I attempted to describe or even only to enumerate all the species that may be seen in the time between low water and flood tide.

Varied as the colours are to be met with among life on the reefs, they are yet surpassed, both in brightness and softness of tints, by those of many fishes of the somewhat deeper water. Among them the different species of parrot-fishes deserve special mention, and anyone who has seen these fishes in their element will agree to the propriety of their being so named. At Rat Island, where the jetty is built with rock, these fishes, as well as other brightly-coloured species, used to be always present in considerable numbers near the end of the structure, feeding among the stones. An opportunity was here afforded me to admire with leisure their beautiful tints, which, in the brilliant sunlight, appeared to the greatest advantage, as they slowly glided through the transparent brine.

Occasionally turtles may be seen in the southern portions of the archipelago and sometimes more numerously in the Wallabi Group, where they are known to lay on the sandy dune of North Island. On two occasions I observed a specimen about two feet in length, when rowing in shallow water near the islets in the neighbourhood of Gun Island, which appeared to be small specimens of *Chelone midas*, the hawk's-bill turtle.

But we must leave the briny element and roam a while over the solid again, for there we will find yet some of the most interesting phases of animal life to record.

The Terrestrial Fauna.

Proceeding step by step, I must, in passing, allude to the insects, which, depending on plants, like these, are scantily represented. Neither are they very varied, although the greater number of orders are represented; nor are the species different from any found near the shores of the mainland in that latitude.

Reptilia are much in evidence, although specifically not numerous, including, so far as is known, only four lizards and two snakes. The lizards are found everywhere, but most abundantly on the guano islands; the snakes are confined to the Wallabi Group. One of the ophidians is the well-known carpet snake, which occurs frequently, and the other the small ringed snake, which hitherto has been recorded only once.*

The avifauna of the archipelago is, however, so profuse in numbers of individuals, and although not comparable as to number of species with the other productions of the animal kingdom, vies with them through the prominence of their multitudes. Owing no doubt to the moderate distance of these islets from the shore to the mainland, several land birds are met with which could not be expected to occur on islands farther in mid-ocean, where also shore birds endowed with lesser flying powers than the true ocean roamers, as a rule, are not found. Through the moderate distance from the continent, together with the evident connection with it of certain portions at no distant geological date, it happens that many of these islands harbour a greater number of species than generally is the case with sea-girthed rocks.

The scene of the immense numbers of birds enlivening the air by flying to and fro over the nesting places, with an equally large number crowding the low bushes and the ground beneath them, sitting on their nests, together with the din of their incessant screeching and calls, which may be heard during the greater part of the night as well as in the day time, is beyond description. Such phenomena require to be witnessed in order to receive a conception of them; but when once beheld and listened to, will leave an impression that cannot be forgotten.

The birds found in greatest numbers are merely visitors of these islets during the summer for the purpose of breeding thereon, and leave after the season to spread themselves again over the vast ocean in the south. From the beginning of September to the middle of October these at other times roving species arrive in large flocks, and, taking up their old nesting places during several months of settled conditions, pursue the interesting object of life, the reproduction of their kind.

Birds and their Nests.

Anous stolidus, the noddy tern, occurs in greatest numbers, and, owing to its habit of building on top of the low bushes, is brought

* According to the British Museum catalogue, four species of frogs occur on the Abrolhos, which, no doubt, means on the Wallabi Group. *Vide* appendix.

most prominently into evidence. On the dense low scrub it depresses the entangled branches, and covering these depressions with a thin layer of twigs and seaweeds, lays a single egg upon them. These nests are crowded close together over the rounded bushes, and frequently are seen also on protruding rocks. But it is interesting to note that on a portion of Pelsart Island, where for the collection of guano the shrubs had to be removed from a large tract, these birds have nevertheless not deserted their habitual nesting place, and now lay on the ground, which is not their usual habit to do. Here I found an immense colony sitting over an area of several acres, so close together that I had to take care when walking over the ground not to step on the birds or their eggs. They do not readily desert their nests on the approach of man, but energetically defend their offspring by pecking at his hands or legs, and make violent darts at his head whilst flying round him.

Below the bushes on which the noddy tern is hatching, the sooty tern, *Sterna fuliginosa*, builds its nest, that is to say, scoops out a hollow in the guano, to deposit its egg in; also only single one, as with the majority of sea birds. In places the sooty tern occurs in as large numbers as the noddy tern, but it is not nearly such a plucky bird. When being approached it generally sets up a screech of alarm, and the greater number scramble from beneath the decumbent branches and hurriedly decamp. If, however, the young is near hatching, or already present, the anxiety to defend it is heightened, and then they may make attempts at pecking at the aggressor.

The lesser noddy tern, *Anous tenuirostris*, occurs most numerously next to the two species just mentioned. Its habitat is the mangrove copses, wherein it nests in crowded colonies. Almost every available position adapted for the purpose is occupied by a nest in these places, and some are built on branches so limp that they bend under the weight. In the mangrove thicket on the northern part of Pelsart Island I counted in some of the stunted trees from 20 to 30 nests. They are constructed entirely of seaweeds, and repeatedly serve the same purpose, after having new material added to them; the droppings of the young have, in consequence of the repeated occupation, covered the outer portions with a white crust, giving the nest a calcareous appearance. Of all sea birds known to me this species builds the most artistic nest, although even then it cannot be compared with many of the simpler kinds constructed by land birds.

At the time of my visit I had the pleasure of observing a great number of these birds engaged in relining some of the old nests and constructing a few new ones. For this purpose they gathered a long-bladed green seaweed that was growing plentifully in the shallow lagoons in close proximity. They either sat on the water and pulled it, or in their flight swooped down and picked up the floating blades some other birds had detached. These long pieces are hung fringe-like over the nest, whilst the centre is lined with shorter and finer material.

ests of the Noddy Tern on Rat Island.*

In common with the greater number of sea birds, this tern hatches only a single egg at a time, but it probably breeds three

* The illustrations have been prepared by Mr. E. James McKagie from photographs taken by Mr. O. Lipfert, who was my companion during the visit to the Abrolhos.

times during the season, because young able to fly, small young, eggs about to hatch, and fresh eggs were present, and, as stated, building was pursued. The bird pluckily pecks at one's hand with its thin beak when being approached, and energetically resists being removed from its nest.

None of the other six species of terns found breeding on these rocky islets are numerous enough to have materially added to the guano beds. They generally appear in small flocks, occasionally numbering from thirty to fifty, and as a rule frequent the margins of the larger and the smaller barren islets for breeding purposes. Here they lay their eggs on the bare rock or on the loose, dead fragments of coral, washed together on certain shores, as, for instance, on the northern portion of Pelsart Island. The greenish-grey ground colour of the speckled eggs corresponds so well with the surroundings of the locality they are usually deposited in that it becomes difficult to see them. My attention was directed to a flock of graceful terns, *Sterna Dougalii*, I had noticed from a distance to be sitting on a ridge of dead coral, and from their behaviour at my approach I felt certain that eggs were lying about; although I happened to come right amongst them, I only found some after a prolonged search, and am convinced that I must have passed a number unnoticed. The downy young of these rock-frequenting birds are, like the eggs, equally well protected by the colour of their plumage.

As with the noddy and sooty terns, several of the light-coloured species often congregate together. When looking for the eggs of the graceful tern, I found in close proximity to some those of the little tern, *Sternula nereis*, proving that these two species also live in friendship together. All sea birds, it is well known, are prominently gregarious, but with the terns this characteristic is stronger developed than with any other group, and, as shown in several instances, extends beyond the species.

Three visitors appearing in considerable numbers, though somewhat later in the season than most of the others, are the wedge-tailed petrel, *Puffinus sphenurus*; the allied petrel, *P. nugax*, which prefers the Wallabi Islands; and the white-faced storm petrel, *Procellaria fregatta*. The first two are known as "mutton birds," and the last as "Mother Carey's chickens."

These birds frequent the edges of the guano islands and sandy places, where they make deep burrows in the ground to sometimes two feet below the surface. Here, on a scanty collection of thin twigs, they lay a single egg. Those of the "mutton birds" are nearly the size of a duck's egg, and of a delicious flavour, and that of the storm petrel about as large as a pigeon's. In every case the eggs are very large in proportion to the size of the bird, and, as with all eggs deposited in hollows, whether under ground or in trees, white, because they do not require a protective colouring. It is a marvel how birds possessing feet apparently so ill-adapted for burrowing can manage to excavate these warrens, which, it deserves noticing, they pluckily defend.

During the day one can see the petrels only when they are dragged forth from their dens, but at night they come out by themselves, and then the weird, mournful howling calls of the "mutton birds" are constantly heard. The habit of seeking food by night, as it is generally believed they do, is very peculiar, and it is evident that they must be able to see in the dark; that to some extent it is so cannot be denied, and probably through passing part of the time under ground, their sight has become adapted to crepuscular vision; but that this characteristic should have developed to the extent of enabling the birds to find food in the dark appears to me doubtful. As the birds are only found singly in each burrow, and none are seen flying about during the day, it seems to prove that the other sex is away at a considerable distance and does not come home till after sunset to relieve its mate, which would have to remain on the nest for twenty-four hours on a stretch. The homing birds would then require to see in the dark merely sufficient to find the warren containing their mates, and no doubt are assisted in being guided to them by the reply to their mournful calls, whilst they could seek food in daylight during their absence. Nevertheless, they may almost deserve to be termed night birds when on their breeding stations, as they are neither seen nor heard in daylight; but no sooner is it dark than they fly about, and their doleful calls are continually heard till after midnight.

The peculiar crepuscular habits of the petrels, and still more their burrowing propensity, characterises this family of sea birds in a striking manner. It is true that the terns and gulls do not go entirely to rest at the fall of night, and especially in moonlit nights, a babel of their cries is heard over their nesting places, but this is merely a continuation of their day habits, and probably to a great extent may be accounted for by repeated disturbances.

A bird totally different from the preceding, and nothing like so numerous, although constantly coming under observation, is the pied cormorant, *Graculus varius*. It is closely allied to the cormorant or shag of the Swan River, and cannot be distinguished from it when flying, except by its slightly larger size. On close examination it is, however, found to differ also by its longer beak, the naked parts about the head, and the speckled plumage of the back; moreover it is an extremely shy bird.

When breeding it congregates in large colonies, and builds its nests on the overhanging edge of some of the lonely islands. Such a shaggery generally consists of several hundred nests, closely placed by the side of each other and constructed of twigs, piled together from five to ten inches above the rock, and lined with seaweed. Considerably more pains is taken over the construction of these nests than is absolutely needed, and as the bird cannot find many broken twigs lying about, it has to break down the low saltbushes for the purpose, as proved by leaves being still attached to the building material.

From three to five greenish-blue eggs, covered with more or less extensive blotches of a calcareous crust, are found in these

nests, the normal number being four; but frequently only one or two are met with, which must be attributed to the long-billed gull, or silver gull, *Larus longirostris*, having destroyed the others. This gull is an inveterate enemy of the cormorant, and watches for every opportunity to devour their eggs. It probably also eats other eggs when an opportunity is offered, but I have not observed another instance, and as the eggs of birds laying in open nests generally are sheltered by protective colouring, they are certainly, when left by their parents, not so readily espied by these predatory birds as is the case with those of the cormorants.

On the occasion of my visit to their habitat, the cormorants hastily departed, and before I could approach the nests a flock of gulls had pounced upon them, and in a very short time devoured several dozen of eggs. As there were over 800 nests along the margin of the island, I could not keep these robbers from the eggs, for when I disturbed them at one end they immediately flew to the other, and did not cease their predatory work till I departed and the cormorants, who had settled on the water some distance away, returned to their nests on seeing my boat leaving.

In the midst of this colony of cormorant nests I found an osprey *(Pandion leucocephalus)* nest, with two almost fully-grown young. It is evident from this that the osprey lives very peacefully with the cormorants. This osprey nest was the only one, beside another I found built on the rock; usually they were found on top of stout bushes, and invariably the densely intertwining *Nitaria Schoberi* is utilised for this purpose.

In starting a nest, as I had the opportunity to observe in one place the bird flattens the top of the shrub by pressing and breaking the thin protruding branches down upon the body of the entangled shrubby growth. The nest above is formed of stout sticks and branches, which frequently are found to be mixed with pieces of coral, appearing as if intended to impart solidity to the structure, over which a layer of seaweed is spread. The finished nest is very flat and from four to five feet in diameter, or large enough to comfortably hold half a dozen full-grown birds, which is an out-of-proportion dimension for the requirements, as a clutch never exceeds two.

Osprey nests are frequently met with, and occur on nearly all the islets. By the heads and other parts of fish found lying over their margins and in the immediate vicinity, it is shown on what food the bird subsists. Fish swimming near the surface rarely escape this hawk when it swoops down upon them. On two occasions I observed one of these birds dart from the air and, after a heavy splash, rise with a fish in its powerful talons.

A still larger bird of prey, the noble white-bellied sea eagle, *Haliaetus leucogaster*, is much rarer, but it was seen several times. The Wallabi Group is its favourite habitat. Its nest can scarcely be distinguished from that of the osprey. It feeds, however, greatly on birds and mammals, and the wallabi, on the Wallabi Island, may have a special attraction for it.

Another characteristic bird of this and similar localities is the reef heron, *Demiegretta sacra*, which generally is met with in pairs. It is a small-sized species of the family, and the common variety has an ashey-bluish plumage; but the rare variety, which is pure white, is also met with occasionally. The nest is made of sprigs under ledges overhanging the water.

Among the birds of rarer occurrence the tropic birds, *Phaeton candidus* and *Ph. rubricauda* deserve mentioning. The latter, with its red beak, its two long scarlet feathers protruding from the tail, and its beautifully rose-tinted white plumage, is probably the finest-looking sea bird in existence.

The gigantic pelican is also met with in these waters, but generally only in small flocks. Its favourite nesting places appears to be the islands North of Sharks Bay.

Of the land birds common to the continent, the welcome swallow, *Hirundo neoxena*, and the green-backed silver-eye, *Zosterops Gouldii*, are seen in many places, although not in large numbers, and during my stay on Gun Island a specimen of the Australian lark, *Anthus australis*, was secured, a bird not previously recorded from the Abrolhos.

I must further mention a few of the birds confined to the Wallabi Group, and which on this account are of special interest. They are—*Numenius cyanopus*, the Australian curlew; *N. uropyzialis*, the wimbrel; *Turnix cintillans*, the freckled turnix quail; and *Hypotænidia philipensis*, the pectoral quail; *Phaps chalcoptera*, the bronze-wing pigeon; and *Anas castanea*, the Australian teal.

The first two, shore birds, belonging to the snipes, are bad fliers, and it is very doubtful whether these and the teal have migrated to the group since it was separated from the mainland, still it is possible; but such can scarcely be the case with the two species of quails, as they could not well fly 35 miles at a stretch; nor is such a feat known of the bronze-wing pigeon.*

The presence of these birds, together with the existence of the carpet snake and four species of frogs, is proof that this group cannot have been separated from the continent till recent geological times, when Australia possessed its present fauna.

Mammalia.

A more unmistakable proof affirming this statement, however, exists in the occurrence of the wallabi, *Halmaturus Derbianus*,

* These remarks were taken exception to after the reading of the paper by an ornithologist who was of opinion that quail could fly such a distance, because they are known to do so in Europe. This, no doubt, is correct, but it must be considered that the old-world species are migratory birds and regularly make their flights impelled by climatic changes and commensurate food supply produced thereby. The Australian quails are not migratory and only change the locality of their habitat to a limited extent, except, perhaps, under extraordinary stress of drought. Moreover, it would be unlikely for them to seek the small islands of the Wallabi Group under such circumstances, and, had they done so they would have found their way back to the mainland after a time. This question, however, will scarcely affect my argument, as it is not based solely upon the peculiarity of bird-life in this group. *See* also, regarding the bronze-wing pigeon, the remarks of Mr. Beddoe s appendix to this paper.

which could not have reached the group except by a land route, unless they were brought there by the agency of the blacks, which is a most unlikely thing.

At present these marsupials are so abundant on the East and West Wallabi Islands that there is no need for using a gun to secure them, as they come across one's path frequently enough to be knocked down with a stick or a stone.

Of other indigenous mammalia frequenting the Abrolhos, the seal, although not occurring very numerously, but found in all its groups, deserves mentioning. It is a species of *Enotaria*, growing to a considerable size.

Rat Island obtained its name from the great number of rats formerly found there, and it is not known whether it was an indigenous species or whether it had been brought there by a shipwreck. The latter seems to me the more probable.

They were so extraordinarily numerous at the time the collecting of guano was first started on the island that they would even run over the table when the men were having their meals, and unless the provisions were kept in iron tanks nothing was safe from them. A considerable number of cats was brought from Champion Bay for their suppression, and these have now entirely destroyed the rodents. But the cats in turn have multiplied to such an extent that they at present commit great havoc among the birds, which fall an easy prey to them. Especially the sooty terns suffer from their aggression, because they lay on the ground beneath the bushes. Hundreds of these and numbers of noddy terns were lying about dead, many with only the head bitten off, proving that the cats kill a greater number than they require for their sustenance, and that they must be still more destructive to the young birds. The slaughter is assuming such serious dimensions that unless something is done to destroy the cats they bid fair to exterminate the birds or drive them off the island.

Another introduced animal is found on Pelsart Island, namely, the rabbit. Some sixteen or twenty years ago a schooner was wrecked on the island. I have forgotten the exact time and the name of the master, but he had a coop with a couple of pairs of these interesting notorieties on board, which he liberated. It is, perhaps, as well that things happened as they did, for at this isolated spot the pest cannot do any mischief. Together with the mutton birds, the offspring of the originally-introduced pairs have undermined the whole Northern part of the island, where it is covered with shell-sand, and one cannot walk over this part without every now and again breaking through up to the knees.

Concluding Remarks.

An area in every respect suited to and offering the greatest opportunities for comprehensive biological studies, situated a short distance from the shore of the mainland and to be reached from Perth, with existing means of conveyance, in 36 hours, should be

more frequently visited by students of nature than at present is the case. When our adopted country has advanced to the stage when higher education becomes an obligatory duty of the State, I have no doubt that much material for investigation will be furnished by these islands and their surrounding seas and reefs, and it may then be that one of them will be chosen for a biological station, as probably few spots on the surface of the globe would be better suited for such a purpose.

Having reviewed, though by no means exhaustively described, the more striking features presented to a visitor to Houtman's Abrolhos, I now close this address, in the hope that I have not wearied you with my discourse. But before parting, I would wish to add a suggestion, namely, that in my opinion this society should expand its sphere of labour to some extent and not stop at investigating and protecting our indigenous flora, but bestow a vigorous attention to our native fauna also, and prevent the existing law for its protection becoming a dead letter.

In modern days acclimatisation has become a kind of fashionable fad, and in all directions societies for this purpose spend large sums of money on their pet endeavours and induce and obtain the assistance of governments. I do not mean to deprecate the fundamental idea of the object in view; on the contrary, I am fully alive to the fact that from an economic standpoint great good may be achieved by the judicious introduction of useful animals of many kinds, and that it is laudable also if the æsthetic receives consideration by the acclimatisation of feathered songsters; but everybody who has given the matter only the most superficial attention must admit that hitherto acclimatisation in Australia has on the whole been a lamentable failure, and that it has done far more mischief—in many instances disastrous mischief—than good. We have bought our experiences at enormous expense, and yet continue experimenting in the same uncertain directions. I will just choose one instance in support of my statement affecting Western Australia.

For years past settlers in agricultural and pastoral areas have clamoured for the destruction of indigenous marsupials, on the ground that they harm their crops and eat much pasture, and whilst in a number of districts the production of scalps is rewarded by a fee, we have the hope presented to us soon to see deer acclimatised in our midst.

To be moderate in my expressions, I will call such endeavours misdirected good intentions, often caused, no doubt, through the innate folly of man to overlook the good around him and seek it at a distance.

I am convinced that the protection of the greater part of our indigenous fauna is more important to the future welfare of our country than appears on the face of it, and far more promising of salutary results than injudicious acclimatisation; and for this reason I felt constrained to point out the errors of it, with the view of

drawing your attention to, and in order to emphasise the necessity of a close and careful study of Nature.

Without dilating further upon the subject at present, I will merely add that there is nothing so mean that would not be deserving of critical observation, as it can never be known to what further results it may serve as a stepping stone.

To make our society a real living institution worthy of its name, and as I know for a fact that there are many amongst us who will agree with me that we can do good work in more than one direction, I have taken leave to bring the field of protecting our native fauna under your notice.

Appendix.

A list of the mammals, birds, reptiles, and frogs occurring on Houtman's Abrolhos:—

**Halmaturus Derbianus*	Derby's wallabi
Euotaria sp.	Seal
Mus sp.	Rat (? introduced)
Lepus cuniculus	Rabbit (introduced)
Felis domestica	Cat (introduced)
Haliaëtus leucogaster	White-bellied sea eagle
Pandion leucocephalus	White-headed osprey
Hirundo neoxena	Welcome swallow
**Sericornis maculatus*	Spotted scrub tit
Zosterops Gouldii	Green-backed silver eye
Anthus australis	Pipit
**Phaps chalcoptera*	Bronze-wing pigeon
**Turnix cintillans*	Freckled turnix quail
**Hypotænidia philipensis*	Pectoral quail
Hæmatopus longirostris	White-breasted oyster catcher
Hæmatopus unicolor	Sooty oyster catcher
Aegialitis ruficapilla	Red-capped dottrell
Tringa albesceus	Little sandpiper
**Tringa subarquata*	Curlew sandpiper
Strepsilas interpres	Turnstone
Limosa uropygialis	Barred-rumped gatwit
**Numenius cyanopus*	Australian curlew
**Numenius uropygialis*	Wimbrel
Demiegretta sacra	Reef heron
**Porzana tabuensis*	Tabuan crake
**Anas castanea*	Australian teal
Larus pacificus	Pacific gull
Larus longirostris	Long-billed gull
Sterna caspia	Caspian tern
St. Bergii	Common tern
St. Dougalli	Graceful tern
St. anaestheta	Panazon tern
St. fuliginosa	Sooty tern
Sternula nereis	Little tern
Sternula inconspicua	Master's tern
Anous stolidus	Noddy tern
Anous tenuirostris	Lesser noddy tern
Puffinus nugax	Allied petrel
Puffinus sphenurus	Wedge-tail petrel
Procellaria fregatta	White-faced storm petrel
Phaeton candidus	White-tailed tropic bird

APPENDIX—*continued.*

Phaeton rubicauda	Red-tailed tropic bird
Graculus varius	Pied cormorant
Pelecanus conspicillatus	Australian pelican
**Morelia variegata*	Carpet snake
* ?	Ringed snake
Egernia Kingi	Lizard
Egernia Stokesi	Spine-tailed lizard
Ligosoma Lesseuri	Lizard
Ligosoma praepeditum	„
**Lymnodynastes dorsalis*... ...	Frog
**Crinia signifera*	„
**Myobatrachus Gouldii*	„
**Hyla rubella*	„

The list of the hitherto known special inhabitants of the Wallabi Group (the species are marked with an *) may yet receive some further additions, if these islets were carefully exploited in search of them. Mr. G. R. Beddoes, to whom I wrote with the object of ascertaining more about the subject, and whether he thought that the bronze-wing pigeon breeds at these islets, kindly writes as follows:—"Besides the birds common to all the Abrolhos, there are in the Wallabies the bronze-wing pigeon, three sorts of quail—stubble quail, red quail, and button quail—and curlew. I am not sure whether the pigeons breed on the islands or not; the bush is quite large enough for them to nest in, and we have always found them, no matter the time of the year of our visit. Snakes are very numerous, mostly good-sized carpet snakes. I have also seen two different kinds of little fellows about a foot or eighteen inches long. There are some lizards on these islands that I have not found on any of the others."

BROWN ROT

(Monilia fungus).

From Albany the following letter accompanying specimens of fruit attacked was received by the Department:—

Stirling Terrace, Albany, W.A., 11th December, 1901.

By post to-day, I have forwarded to your department one small box containing a few plums, two of which are green and in their natural state; the rest are a sample from the same tree. The fruit grow and bloom splendidly and attain the size of the green ones, then wither and drop off in hundreds. The soil is a strong black and heavy clay subsoil, mulched every year; in fact, every attention is given to them. Kindly, if possible, let me know the best course to pursue. The two trees are about eight years old. This is the second year the fruit has dropped.

Yours, etc.,

JAMES EDWARDS.

To the Secretary, Agricultural Department.

After an examination of the fruit, Mr. A. Despeissis, the Horticultural Expert of the Department, reported as follows:—

The plums submitted are attacked by the Brown Rot of the Plum (*Monilia fructigena*, Pers.)—a fungus attacking as well cherries, apricots, peaches, and sometimes apples and pears. It is one of the most destructive diseases of that fruit, and one of the most difficult to check.

The monilia fungus is greatly influenced by the weather, being more severe when misty days and high temperatures prevail.

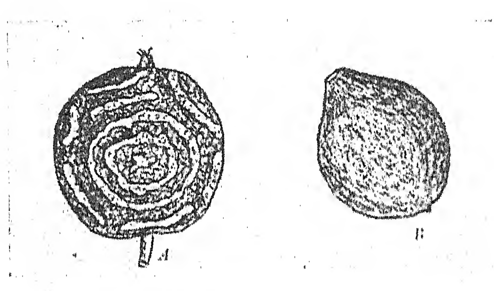
All parts of the host are attacked. Upon the leaves it is found on a reddish or yellow spot; within the tissue of the leaves the mycelial threads spread rapidly, giving off tufts of reproducing cells. The fungus also penetrates fruit through the unbroken outer skin and the affected fruit gradually shrivels up, becoming brown, shrunken, and soft. Finally it attacks the stalk to which the fruit is attached, causing it to fall to the ground, or drying up the remains as "mummies" on the tree, until the following spring, ready to spread the infection as soon as the host is provided.

As remedial measures, care for rotted fruits and copper salts sprayings do a certain amount of good. All diseased leaves and fruit should be picked and burned as soon as possible, as well as all mummies left hanging on the tree. In the spring, before the buds burst, washing of stems with a solution of iron sulphate is suggested, also spraying of young foliage with dilute Bordeaux mixture. In unfavourable seasons this spraying should be repeated several times at intervals of a fortnight.

A report from the Ohio State Horticultural Society, 1898, records "A fair crop from the sprayed trees, the loss from brown rot being 33 per cent. while the loss on the unsprayed trees was 84 per cent."

A. DESPEISSIS,
Horticultural and Viticultural Expert.

16-12-1901.



Monilia Fructigena.

A—Apple showing the grey conidial patches as more or less concentric lines.
B—Young Peach shrivelled up in consequence of attack (*Tubeuf*).

HOW TO MAKE SMALL CHEESE.

The Commonwealth tariff tends to develop cheese-making in the State, hence the value of the following article:—

To give full directions for making cheese to one not accustomed to "curd mixing" would be no easy task, and I should not care, to guarantee the product. Since I have gone on record advising cheese as a daily food, on account of its digestibility, I fear the maker, if he has no other source of knowledge, only what he may glean from these notes, may consider that I am "off" on cheese as a food or on methods. Here are a few principles and rules that may be given, and if good judgment is used may prove satisfactory.

We will assume the quantity of milk to be 500 pounds of 4 per cent. milk, and if more or less the amount of rennet, salt, etc., may be changed accordingly. The night's milk should be kept at a temperature of sixty-five degrees Fahrenheit, after being exposed to the air after milking. In the morning mix the two milkings together in a vat or tub not exceeding twenty inches deep—fifteen inches would be better. The curd would cook more thoroughly, with less danger of packing in the bottom. A very simple and effective way of heating will be to use two small cans seven inches in diameter, and high enough to come above the milk. Fill these cans with hot water, moving the cans and agitating the milk until warmed to eighty-four degrees. If one desires coloured cheese then add one-half ounce of some standard cheese colour, mixed with a half-pint of water; mix thoroughly. Provide yourself also with one and one-half ounces of rennet extract. Put the extract into a half pint of cold water; do not use warm water or keep it where it is warm, and add to the milk, stirring for two minutes. In about twenty-five minutes the coagulated mass will be ready to cut. Put the finger gently into the curd, and when it breaks clean over the finger it is ready. If no cheese knife is at hand, previously provide yourself with a piece of galvanised iron woven wire with a half-inch mess, about 6 x 15 inches; draw it through the mass length-wise, crosswise, and from top to bottom. Of course it is a crude way of cutting, but will serve the purpose of breaking the mass and starting the whey. Keep the mass stirred so each particle will remain independent of another. In ten minutes the heating cans should be brought on again, filled with hot water. Keep them moving as well as the curd, to prevent overheating any portion of it. When the thermometer registers ninety-eight degrees rake out the cans and keep the mass stirred until the curd particles do not readily adhere; then stir occasionally until—well, let's see. This point is not so easily told.

The old, old way was to take off the whey when the curd squeezed between the teeth—that's not bad. I should, of course, rather depend upon the feeling and by smelling, but the beginners would better use the first rule mentioned, aided by the feeling.

Take a handful of curd, squeeze it hard, let go. If it has an elastic feeling, showing it to be well dried out, then take off the whey. Keep the curd well stirred until it is free from moisture and cool, which will require about half an hour. It may be more convenient after removing the whey to take the curd into some other receptacle, where the moisture will drain out more easily and quickly, either by a slanting bottom or a rack with a cloth over it, through which the moisture can drip. One pound of clean salt will be sufficient; add and thoroughly mix, and allow to remain before pressing, for fifteen minutes. Two hoops eleven inches in diameter and fourteen inches deep, or one hoop fourteen inches in diameter and fourteen inches deep, will be needed, or, if small twelve pound cheeses are wanted, get four seven-inch hoops one foot deep. The amount of cheese produced from the milk will depend upon its fat content. One can safely figure 2·65 pounds cured cheese to each pound fat in the milk, if the milk contains anywhere from $3\frac{1}{2}$ to $4\frac{1}{2}$ per cent. butter fat. Take a cheese bandage to fit, and long enough to project past each end, one inch or even two inches; it can be cut off. The bandage may be placed in before cutting in curd and turned over the top edge of the hoop to hold in while filling; use a round piece of cotton cloth at each end of the cheese. I would not advise any cheap uncertain method of pressing; a one and one-half inch screw set in a frame with means of turning; or send to a dairy supply house and get a press. If sufficient pressure is not applied the rind will not form, and the whole job will be a failure. After pressing an hour, take out, adjust the bandage smooth and cover the edges nicely, put on cap cloths of same material, with the cotton press cloths on top, and at the bottom the same; put on a closely-fitting follower, put to press again and keep it there until the following day. Then take it out and cure in a room from sixty to sixty-five degrees for three weeks. If you have not slipped a cog somewhere the cheese will be presentable and eatable. From an economic standpoint, however, the job will be a failure. An equal amount of cheese can be purchased much cheaper of some reliable manufacturer or dealer—quality guaranteed.—H. E. COOK in *Rural New Yorker*.

DESTRUCTION OF PRICKLY PEAR.

Some little time ago the Queensland Government carried out some experiments in order to determine the efficacy of certain methods of destroying the prickly pear. For the scene of their operations they selected Bunkers Hill, comprising 145 acres of the worst country in the Westbrook area. The hill was very steep, and was covered with a dense and very high growth of prickly pear. Five men were engaged and the work begun. At the outset it appeared as if an almost hopeless task had been undertaken; but once a footing was gained the work went steadily on, with the result that the hill some months after showed not a vestige of prickly pear.

The work was carried out thus:—The men, armed with special matlocks, and protected with leather leggings to the thigh, attacked the cactus, chopping it to the ground. The thickest leaves and the stem were then slashed with the matlock, and the stump was chopped to shreds, but not extracted. Then the leaves and stump were sprayed well with a solution of sodium arsenic, care being taken that the whole of the surface of the leaves were wetted, the spraying being carried out with knapsack spray-pumps.

This was the whole of the operation, and the result was surprising. After three or four days the green, succulent, fleshy leaves wilted and turned brown, finally drying up and cracking under foot like dry pea or bean pods. Not only are the leaves destroyed, but the spray has so permeated the stump to the very end of its long roots that they are utterly rotted and turned into a rich humus. Singularly enough, the spraying has no bad effects upon the grass, which, on the contrary, seems to derive additional vigour from the application. The whole area treated is now a valuable grazing property, covered with most luxuriant grass, intermixed with masses of beautiful wild flowers.

The preparation of the sodium arsenic is made as follows:—4lb. of white arsenic, 3lb. washing soda, in 1 gallon of water, boiled and stirred for half an hour; 5oz. to 8oz. of the solution were used per gallon of water in spraying.

THE DAIRY COW

And how to Manage Her.*

There are certain well-known characteristics in the dairy cow which those who make dairying their work know quite well. She must have a good roomy trunk, well-sprung rib, straight in her back, fine sloping shoulders, thin neck, with a sweet head. But the milk vessel is of most importance. When in full milk it should be of ample capacity, and with teats evenly distributed on the bag, and good milk veins running well forward. If these points are well developed, they usually point to a good dairy cow.

But it does not matter how good the milking properties of a cow may be, for if the food supply is not of a nature adapted for milk, these properties will not be developed. The food should always be easy to assimilate. It should also be abundant, so that the cow may be able to consume all that she requires in as short a time as possible. She will then have more time to rest and secrete her milk, and the milk to acquire its richness. While at pasture in summer, when there is plenty of grass, the cow can easily keep up her flow of milk, but when the grass begins to fail, if that flow is to be maintained, the cow will need some extra allowance of food.

Aftermath and Tares.

Good aftermath or tares come in very handy at this season, but, if these are not to be got, a good substitute may be given in a feed of bran and grain, damped with water, or a mixture of linseed and cotton cake—about 1lb. of each. When tied up, a liberal supply of good fresh turnips should be fed to her, with the addition of 2lb. of cake. The cake adds greatly to the richness of the milk. If turnips are scarce, a feed of bran and grain, damped with water, and 1lb. of treacle, will be a very good substitute for the mid-day meal. A little draff might also be added if it can be got. A liberal supply of good, wholesome straw should also be given, and it should be remembered that barley straw does not do so well with dairy cows.

Food practically consists of whatever an animal or plant may take for the purpose of supporting life and adding to its sustenance. In this respect water is of the utmost importance. Were it not for the large proportion of water in the system, the blood would cease to flow in the veins, and life could not exist. Water is absorbed into the system with great rapidity, and in a few minutes it is passing through the veins in the blood and from the blood into the milk. Water must, therefore, be quite pure, as it carries with it into the milk through the blood any impurities it may contain.

* "The Haddo House Essay," By Mr. Adam Sutherland, Tarves.

Lean Cows as Milkers.

Some people have an idea that lean cows are the best milkers and fat ones quite the opposite. Their theory is that a lean cow uses most of its food for the purpose of making milk instead of putting it on her back in the form of fat or flesh. This idea is not quite correct. It has often been found that fat cows will give as much milk as lean ones, and it is usually richer.

Next to food, warmth is a very important point. An animal that is always cold must use a larger percentage of its food for the purpose of forming blood and keeping up the heat of the body. Colds and sudden chills should be guarded against as much as possible, as they are very often the cause of a falling away of milk. Draughts in byres and cow-houses should also be guarded against at all times, but especially after calving, as they are very often the cause of "weeds."

Cows should always be put dry about six weeks before their due time to calve, to give them rest and allow nature to recruit. After a cow has calved, she must be well attended, both as to food and drink. Warm drinks should be given for a few days, with a handful of salt and oatmeal or bran well stirred through the water. They should be carefully fed for a few days, until the system has again attained to its normal state. A dose of medicine may be given with advantage, more especially in the case of heavy milkers. It may prevent or alleviate to some extent milk fever, which usually shows itself from a few hours after calving to about the third day.

Some dairymen are very much in favour of giving a light dose of medicine every three days for 10 days before calving, if the animals are dropping during the warm summer months. At this season, too, they should not be allowed to get too much grass. It has a tendency to make the milk come quicker than turnips, and therefore the risk of milk fever is much greater.

The udder should not be quite emptied at the first milking, as it has been found that cows which are milked thus are more liable to take fever than those which are milked clean. The udder must be well attended to for a few days, until it is broken. If it does not seem to break up easily, some white camphorated ointment well rubbed in with the hand will be found of great advantage.

A Creature of Habit.

The dairy cow is very much a creature of habit; therefore, regularity in milking is of great importance, as anything that unsettles her will react on her yield of milk.

Other two points worth attending to are gentleness and quickness. Gentleness for the reason I have named above. Rough handling unsettles the nervous system, and a quick milker is seldom a bad milker. The quicker the udder is emptied, the more will the milk-yielding powers of the cow be stimulated. The udder must be thoroughly emptied at each milking, for if this is not done it tends to dry up the cow, and, besides, the strippings are the richest part

of the milk. It is only by exciting more and more the mammillary glands which secrete the milk that the cow has been made to give more milk than will bring up a calf.

Cows must not be driven home from the field too fast, and should be allowed to stand for about half-an-hour to allow the nervous system to settle down, as, after being driven any distance, they are always more or less excited.

It is perhaps not generally known that the bag does not contain all the milk which is got from the cow at one milking. The secretion of milk to some extent takes place after milking has begun. But not only must the cow be well fed, gently treated, and quickly milked, she must be kept clean and tidy. The byre and cow-shed must be kept sweet and clean. It is also of very great importance to have the byre properly ventilated, the ventilation being always from above the animal.

If all the points I have above mentioned be attended to, I believe that satisfactory results will be obtained from the dairy cow.

GRAIN IN BULK.

In the September number of the *Journal* an article was published by Mr. P. Wicken, giving an account of the shipment in Sydney of the first consignment of grain forwarded to Europe in bulk. This grain has now arrived in Liverpool in perfect order and condition, and the following report has been received by the Secretary of the Board of Exports, Sydney:—

"I am informed that the price realised for the bulk shipment of wheat per steamer Persic, was 27s. per quarter, and, considering the unfortunate condition of the market at the time, this price was considered extremely satisfactory. No difficulty was experienced at the port of discharge, for the simple reason that at Liverpool they have every facility for handling bulk wheat. Mr. Fairbairn, of the Co-operative Wholesale Society, who shipped the wheat, sends the following reports from the harbour authorities at Liverpool: 'The bulk of grain *ex* Persic is now all on quay, and, I am glad to report, is in really good condition. It is cool, dry, and clean, and it is quite equal in every respect to that carried in bags. In the opinion of several connected with the grain trade, this experiment must be considered a complete success, as the condition could not be improved on.' Then, in continuation: 'In further reference to previous report, the bulk wheat by this steamer was shipped by the Co-operative Wholesale Society, and taken up here by Messrs Charlton and Bagshaw. I understand that parcel has arrived in excellent condition. The wheat in this instance was landed on quay by elevator.'"

INSECT PESTS ACT.

MONTHLY REPORT.

During the past month the work of inspection has been confined to the vicinity of Perth, a careful watch being kept in anticipation of the appearance of the fruit fly in early fruits. At the time of writing, the fly has been reported in apricots at West Perth, Coogee, and near Armadale. So far but little damage has been done by the fly, but there is tolerable certainty of the pest assuming more dangerous proportions as the season advances; and it is to be hoped that all persons who have fruit growing in Perth and other infested localities will do all in their power to keep this destructive little insect in check. This can best be done by picking all ripe fruit off the tree daily. Any fruit found to be infested with maggots should be at once burnt or destroyed by boiling. Fruit should never be allowed to lie and rot on the ground, as by this means the maggots are enabled to escape into the soil, from which they reappear in the course of a few days in the adult form, to again engage in the destruction of any fruit that may be within their reach. If all fruit falling to the ground be picked up and destroyed daily the spread of the pest must be materially retarded.

Considerable quantities of fresh fruits are now going through the various auction rooms and markets in the city, and the condition of the fruit is most satisfactory.

The importations of fruit during December totalled 10,157 cases, of which 748 cases were destroyed by the Inspectors at the various ports, 104 cases being diseased, and the balance being in a decayed condition. The apples and pears to hand so far this season are rather severely affected with codlin grub; shippers are apparently not sufficiently careful in examining the fruit at the port of shipment. Notwithstanding the fact that cherries, plums, and other perishable fruits formed a large proportion of the imports, it will be seen that the percentage of fruit destroyed was not excessive, the quantity affected with disease being particularly small, only a shade over 1 per cent. of the total importations.

G. BUCHANAN,

Acting Chief Inspector,

8th January, 1902.

PASPALUM DILATATUM.

SUCCESSFUL CULTIVATION.

Mr. M. J. Maidment, Nambong, Bridgetown, has written to the Secretary to the Department of Agriculture as follows:—"Some two years ago I obtained from you some of this *(Paspalum Dilatatum)* seed, and I can honestly say it is the best grass we can grow in the Warren district. It has reached six feet in height, and has yielded at the rate of ten tons per acre. This was on the poorest sand that I have, and it will also grow in the stiffest black clay, into which I transplanted some last year. This grass is far and away above any other varieties of grass that I have sown here, and for fattening stock it cannot be beaten. I have grown many other varieties of grass, and am quite convinced that this is the best."

The following letters have appeared in the *Argus*:—

FREE DISTRIBUTION.

Sir,—Paspalum Dilatatum is such a wonderful fodder plant that this association last year imported a special lot of seed and distributed it gratis to all applicants, regardless of whether they were members of the association or not. We thus distributed between 3,000 and 4,000 packets, and, though it is now rather late for planting, unless carefully looked after, we have still a small quantity for free distribution, and if applicants will send stamps to cover the cost of postage will be glad to send out what we have left.—Yours, etc.,

A. Frank Buckley,
Secretary Victorian Silk Culture
and Rural Industries Association.

Dec. 16.

Sir,—With reference to the statements made in Parliament lately by Mr. Madden and others as to the advantage of the above-mentioned grass being used as a fire-break if planted along the railway lines, I beg to state that I have made an experiment with this grass at North Shore, Geelong, and can bear testimony to its value in this district as a fodder plant of no mean value to dairy farmers and others feeding stock at this season of the year. I am convinced, notwithstanding its failure at Dookie (which place is known to me as an old student there as one of the hottest and driest districts in the state, being most suited for vines and wheat-growing in good seasons), that if this grass was planted along the railway line, for a commencement, in quarter-acre lots, say, every half-mile between North Shore and Port Fairy, I feel certain that

there would be sufficient moisture in these parts to make certain of a good growth, and from this area new rooted plants could then be secured to plant the unplanted portions along the railway lines. and also provide for sale to dairy farmers and others interested in these localities, at a cheap rate, rooted plants for planting on the farms adjoining the railway line.

If this method could be agreed upon, I feel certain not only would a good fire-break be established, but a great boon would be conferred on the dairy farmer in these particular parts, and the land along the line, now almost useless except for starting fires, would become a valuable asset to the state.—I am, etc.,

J. H. CONNOR,
Geelong, Dec. 23. Dairy farmer.

LARGE BLACK PIG.

With reference to the paragraph which appeared in the December issue of the journal, drawing attention to the importation of pigs, by Messrs. Elder, Smith, & Company, who claim that they were the "Large Black Essex Pig," Messrs. Richardson Bros., of Wooroloo, writes:—

In the last issue of your journal you illustrate a South Australian boar, and describe its breed as the Large Black Essex. May we point out that this is an incorrect classification. The breed of swine known as Essex have no other resemblance to the boar illustrated than their colour. The Essex pigs are prick-eared, and are built upon very similar lines to the Berkshire type. The pig you show belongs to the breed which has been authoritatively classified as "Large Black," and as we have imported from England a fashionably-bred boar and sow, and have another sow landing in March, anyone anxious to make closer acquaintance with this popular English pig can do so nearer at hand than South Australia.

The matter being referred to the Field officer of the Department, Mr. Wicken replied:—

Messrs. Richardson Bros. are correct; the boar illustrated has no resemblance to the Essex breed. The paragraph in the paper was taken from Messrs. Elder, Smith & Co.'s letter, in which they call it a Large Black Essex boar.

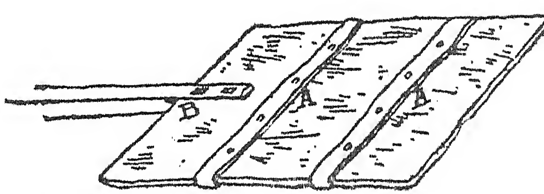
In reality it has no resemblance to the Essex. The ears of the Essex are very small and prick shaped, while the Large Black have large ears hanging down over their eyes.

The Large Black is a recognised distinct breed, and have a herd book of their own established in England in 1898.

A USEFUL FIRE-BEATER.

(From "The Australasian.")

"The fire-beater shown in our sketch is one in use at Bolindavale Estate, and has proved thoroughly trustworthy wherever it has been tried. It consists of a piece of stout bullock hide 2ft. long by 16in. broad. It is inserted in a cut made in the end of an ash fork handle, and secured by a couple of bolts and nuts (B). There are two pieces of hoop-iron across the hide, secured by rivets, but Mr. R. Clarke has arrived at the conclusion that the beater acts as well without the hoop-iron. Though the hide stands well, at times the beaters become shrivelled, and this winter Mr. Clarke intends tanning a couple of hides on the estate, as he believes leather fire-beaters would last for many years. His suggestion that the local shire council should have a large number of these fire-beaters ready for use on any serious emergency is worthy the consideration of municipalities in all parts of the country."



The above appliance has been strongly recommended by the Landowners' Association of Victoria, who urges all farmers and graziers to keep at least a dozen of these fire-beaters always on hand, and to have fire-breakers around the place.

CREDIT FONCIER.

At the Conference of Producers held in Perth last year a resolution was carried "That in the opinion of this Conference the Agricultural Bank Act should be so amended as to bring it into conformity with the Credit Foncier System."

The matter being referred to Mr. Paterson, manager of the Agricultural Bank, that gentleman, in replying, approved of the adoption of the system, and enclosed the following information on the matter obtained from Mr. Chas. H. Wickens, A.I.A.:—

In R. H. Inglis Palgrave's "Dictionary of Political Economy" it will be seen that the name "Credit Foncier" was, about the middle of the last century, given to a French banking company, whose operations at first consisted in making advances on houses and rural property, but which later on were extended to include advances to local governing bodies, and also to cover other branches of loan transactions. The funds required for these purposes were raised by the issue of mortgage and communal bonds.

This company is subject to government supervision and restriction, but is not, as erroneously stated in T. A. Coghlan's "Seven Colonies of Australasia," an institution exclusively administered by the State. The governor and two deputy governors are appointed by the government, and various regulations are imposed respecting the nature of its business and the methods of transacting it, but the shares are privately owned, the board of directors is elected by, and the profits belong to, the shareholders.

In Australasia systems of State advances to settlers have, in Victoria, New South Wales, South Australia, Western Australia, and New Zealand, been brought into existence by legislative enactment, and these systems, though all agreeing in the object in view—the assistance of settlement on the land—differ considerably in the details of the methods for providing such assistance. None of these systems are officially spoken of as "Credit Foncier," though, as will be seen in the publication mentioned, "The Seven Colonies of Australasia," the whole of them have been referred to as belonging to this system. If this use of the term "Credit Foncier" as applied to Australasia be the correct one, the system may be defined as that in which funds raised by or guaranteed by the State are obtained by the issue of bonds, debentures, or inscribed stock, and are advanced to settlers on the security of their holdings, such advances being repaid by instalments extending over a considerable number of years.

The system in force in New South Wales is evidently only intended to tide over the bad times, brought about by successive droughts, and consequently is not as fully developed as is the case in the other States, where the institution appears to be of a more or less permanent character.

The main points on which the Western Australian system differs from those of Victoria, South Australia, and New Zealand are—

(1.) The method of management.

(2.) The limitations concerning the purposes for which advances may be made.

(3.) The fact that in Western Australia the maximum advance depends upon the value of the improvements to be effected, in the other States, upon the value of the land.

(4.) The method provided for the repayment of principal.

As far as I have been able to judge, there can be little objection to the extension of the operations of the Agricultural Bank to cover advances to settlers for any purpose whatever connected with the settlement of land, provided that the valuations of the holdings on which the advances are secured have been carefully made, and a sufficient margin has been allowed; special precautions being taken in the case of land which has acquired an additional value owing to its cultivation as an orchard or vineyard.

The adoption of the repayment method in vogue in Victoria, South Australia, and New Zealand, by which the half yearly payments, including interest and repayment of principal are uniform throughout the currency of the advance, would, I think, be appreciated by the borrower, and would be conducive to satisfactory results.

If it is considered desirable to extend the present system of advances, I shall be very pleased to assist in preparing a draft of a Bill to provide for such extension, and I shall then have an opportunity of bringing under your notice several minor points on which I think improvements might be effected.

The following extracts from publications referred to are given for the information of our readers:—

Dictionary of Political Economy.

R. H. Inglis Palgrave.

Art.—*Crédit Foncier of France*, Vol. I., p. 454.

This institution is intended to enable house and land owners to raise money on mortgage at a low rate of interest, with facility of repayment by an annuity including redemption of the capital. The foundation of the *Crédit Foncier* was due to the economist M. Wolowski. It dates from 1852, but had been preceded in 1820 by a mortgage bank called the *Caisse Hypothécaire*, which, after a struggling existence, was finally liquidated in 1846. The new establishment was created under governmental patronage, and invested with special privileges which constituted a virtual monopoly. The original idea was to found a number of mortgage banks, each with its operation confined to a prescribed region. Three only were organised, those of Paris, Nevers, and Marseilles; the last two were afterwards absorbed by the first, the operations of which were then extended to the whole of France. They were styled *Banques Foncièrs* with the name of the locality. On their amalgamation the subsisting one was called the *Banque Foncière de France*, but on representations by the Bank of France, which feared a confusion from the similarity of names, the title was changed to that of *Crédit Foncier de France*.

The operations of this establishment were at first restricted to loans on houses and rural property, with or without redemption by a sinking fund. They were extended in 1858 to loans for drainage; in 1860 to Algeria; and in 1860 the *Crédit Foncier* was authorised to lend to towns and departments. This last extension contributed in a great measure to the vast public works commenced under the empire, and since continued. The *Crédit Foncier* was also empowered in 1860 to make advances in the form of discounts to the *Sous-Comptoir des Entrepreneurs*, a contractors' bank, which lends on mortgage to builders after their work has reached a certain stage, and while in progress; the *Crédit Foncier* itself only granting loans on houses when ready for occupation. When the buildings are finished the bills discounted by the *Sous-Comptoir*, and rediscounted by the *Crédit Foncier*, are cancelled by a regular mortgage to the latter company.

The *Crédit Foncier* patronised in 1861 the formation of an institution called the *Crédit Agricole*, for advances to agriculture not authorised by its own statutes, and which it assisted in a similar manner by rediscounts. This association involved the *Crédit Foncier* in difficulties in 1876, the *Crédit Agricole* having imprudently taken in nearly seven millions sterling of Egyptian floating debt, and passed them on to the *Crédit Foncier*. The Egyptian Government having made default, the *Crédit Agricole* had to go into liquidation, and was merged in the *Crédit Foncier*, shareholders receiving a part of their capital in new *Crédit Foncier* shares. The *Crédit Foncier* also absorbed in 1882 a rival mortgage bank called the Banque Hypothécaire, which had been founded on the expiration of the exclusive privilege of the former, which had been only granted for twenty-five years. That operation gave rise to a further creation of shares, and as the business of the *Crédit Foncier* increased, new capital had to be raised, the right of issue of mortgage and communal bonds being limited to twenty times the share capital, the present amount of which is £6,820,000, with a limit of £8,000,000.

The Government exercises a direct control over the *Crédit Foncier* by the appointment of the governor and two deputy governors. The decisions of the elected board of directors are not valid without the approval of the governor.

The *Crédit Foncier* enjoys the special privilege of issuing bonds which, in addition to the fixed interest, give a right to drawings for prizes. Each issue of bonds with a lottery requires, however, a special authorisation by the Government. The *Crédit Foncier* can only lend on first mortgage, and to the amount of one-half the estimated values of houses and farms, and one-third of that of vineyards, woods, and other plantations. The commission or profit on mortgage loans cannot exceed 0·6 per cent. or an addition of 60 centimes to the rate of interest paid by the *Crédit Foncier* on its mortgage bonds of the preceding issue. The present rate (1890) for loans without amortisation is 4½ per cent., including commission. The annuity, interest, and sinking fund is 12·52 per cent. for a loan to be redeemed in 10 years; 7·63 per cent. in 20 years, 5·04 per cent. in 50 years, and 4·66 per cent. in 75 years. Borrowers have always a right of reimbursement on specified conditions. The rates for loans to local bodies, communal or departmental, are lower, being calculated on interest at 4·2 per cent.

The total amount of mortgage loans granted by the *Crédit Foncier* down to the end of 1891 was £144,004,661, of which £77,976,789 was outstanding. About one-fifth of the extinctions, amounting to £66,027,872, had been effected by the working of the sinking fund, and four-fifths by the exercise by borrowers of the right of liberation. The loans were about equally divided between property in Paris and the environs, and in the rest of France and Algeria. The communal and departmental loans amounted to £82,670,891, of which £47,285,961 remained due on 31st December, 1891. The nominal amount of foncier and communal bonds in circulation at the same date was £161,101,564, representing a realised sum of £122,376,926. The charter of the *Crédit Foncier* is now extended for a period of ninety-nine years from 1881.

State Advances to Settlers in Australasia.

Particulars.	Western Australia.	New South Wales.	Victoria.	South Australia.	New Zealand.
LEGISLATION—					
Acts passed	(1.) "The Agricultural Bank Act, 1894" (58 Vict., No. 21) (2.) "The Agricultural Bank Act, 1894, Amendment Act, 1896" (60 Vict., No. 5) (3.) "The Agricultural Bank Act Amendment Act, 1899" (63 Vict., No. 25)	"Advances to Settlers Act, 1899," (Act, No. 1, 1899)	"Savings Bank Act, 1890, Amendment Act, 1896" (60 Vict., No. 1481)	"The State Advances Act, 1895," (58 & 59 Vict., No. 633)	"The Government Advances to Settlers Act, 1894" (58 Vict., No. 38).
ADMINISTRATION—					
Office by which administered ...	Agricultural Bank	... ...	Savings Bank	The State Bank of South Australia .	The Government advances to Settlers Office.
Constitution of Board	... ...	Not more than 3 persons appointed by the Governor	Savings Bank Commissioners ...	Five trustees appointed by the Governor	Seven members, including the Superintendent.
Chief Executive Officer	Manager	... ...	... ...	Inspector General	Superintendent.
FUNDS—					
How obtained	(1.) By sale of Mortgage Bonds (2.) From moneys provided by Parliament	By issue of Inscribed Stock ...	By Sale of Mortgage Bonds	By Sale of Mortgage Bonds	By Debentures or Scrip, or by the issue of Inscribed Stock, or otherwise.
Form of security	See Schedule to principal Act. May be varied	... ...	See First Schedule to Act	See Schedule to Act. Form may be varied.	
Maximum to be raised	£200,000	£500,000	£2,000,000	£3,000,000	£3,000,000.
Face value of Bonds, Stock, etc., issued	£10, £25, £50, £100, £500, £1,000	£10 or some multiple thereof	£25	£10 or some multiple thereof.	
To whom Bonds, etc., are payable	Bearer or Order	Inscribed holder ...	Bearer ...	Bearer.	
Currency of Bonds, etc.	Not exceeding 20 years from date of Bond	Not less than 20 years from commencement of Act	... ...	Not less than 5 years from date of issue	To be prescribed by agents appointed to issue same.
Rate of Interest to be paid ...	Not exceeding 5 per cent. per annum ...	Not exceeding 3½ per cent. per annum	Not exceeding 3½ per cent. per annum	Not exceeding 4 per cent. per annum	To be prescribed by agents.
Redemption of Bonds, etc. ...	By annual drawings, commencing after expiration of six years from date of issue	... ...	By half-yearly drawings ...	By drawings.	
Minimum price of Bonds, etc. ...	To be fixed by Colonial Treasurer ...	... ...	Par	To be approved by the Governor ...	Such price as will yield to purchaser not more than 4 per cent. on purchase money.
ADVANCES—					
Persons to whom advances may be made	Farmers and other cultivators of the soil	Holders of Freehold land, Crown Lands in process of alienation, and leased Crown Lands	Farmers, graziers, market gardeners, or persons employed in agricultural, horticultural, viticultural or pastoral pursuits	(1.) Farmers and other producers. (2.) Local authorities. (3.) Proprietors of Industrial Establishments.	
Property on which advances may be made	Holdings (a) in fee simple; (b) under S.O.L.; (c) under C.P.; (d) homestead farms	(1.) Freehold land (2.) Conditional purchases (3.) Homestead selections (4.) Crown Leases	(1.) Land held in fee simple (2.) Crown Leases under which rent reserved in part payment of purchase money	(1.) Lands held in fee simple (2.) Crown Leases (3.) Rates	Land other than urban or suburban which is either (1.) Freehold in fee simple. (2.) Crown; Native and other Lands held under specified Acts.
Security to be taken	First mortgage and transfer of lease ...	Security to satisfaction of Board	First Mortgage	(1.) First Mortgage. (2.) Deed charging Rates.	First Mortgage.
Limits of advance	(1.) Not more than ½ of value of improvements (2.) Not more than £800 to any one person	Not more than £200 to any one holder	(1.) Not more than ⅔ of actual value, plus ½ specially acquired value in case of orchards, vineyards, etc.; such additional value not to exceed £30 per acre. In case of Crown Leases, rents payable prior to issue of Crown Grant to be deducted (2.) Not less than £50 nor more than £2,000 to any one person or firm	(1.) Not more than three-fifths of unimproved value and permanent improvements plus ½ of specially acquired value in case of orchards and vineyards. In case of Crown Leases subject to right to purchase; unpaid purchase money must be deducted, and in other case unimproved value (2.) Not more than £5,000 to any one person, firm, or company (3.) Special limits in case of loans to local authorities	(1.) Not more than three-fifths value of freehold lands nor more than ½ value of lessees' interest in case of lease. (2.) Not less than £25 nor more than £2,500 to any one person.
Purpose for which advances may be made	Improvements on holdings, clearing, cultivating, ring-barking, fencing, draining, wells of fresh water, reservoirs, buildings, and other improvements approved by the manager	For relief of settlers in necessitous circumstances owing to droughts	(1.) To pay off existing liabilities (2.) To make improvements or develop agricultural, horticultural, and viticultural or pastoral resources	(Not specified except in case of advances to local authorities)	For the relief of settlers who are heavily burdened by reason of the high rates of interest charged on mortgage of land, and the heavy incidental expenses connected therewith.
Rate of Interest	Not exceeding 6 per cent. per annum ...	4 per cent. per annum ...	4½ per cent. per annum	Not exceeding 5 per cent. per annum ..	5 per cent. per annum.
Interest Payable	Half-yearly	In such amounts and on such dates as the Board may determine	Half-yearly on 31st March and 30th September	Half-yearly on 1st April and 1st October	Half-yearly.
Currency of advance	Not exceeding 30 years	Not exceeding 10 years	31½ years, or such shorter term agreed to by Commissioners and borrower; 15 years in case of orchards, vineyards, etc.	Any complete number of half-years between 7 years and 42 years	36½ years.
Repayment	To commence from 1st January or July next following date of advance. Not less than 1-50th of principal to be repaid half-yearly	In such amounts and on such dates as the Board may determine	By half-yearly instalments, which together with interest make up a uniform half-yearly payment of £3 per £100 borrowed; £5, or any multiple thereof, may at any time be repaid, and will be accumulated at 3½ per cent., but will not affect uniform payments	By half-yearly instalments, which together with interest make up a uniform half-yearly payment. Repayment in part or in full may be made at any date of interest payment	By half-yearly instalments, which together with interest make up a uniform half-yearly payment of £3 per £100 borrowed; £5 or any multiple thereof may at any time be repaid, and will be accumulated at 4 per cent., but will not affect uniform payments.

The Seven Colonies of Australasia, 1899-1900.

T. A. Coghlan.

"*State Advances to Farmers*," p. 545.

The oldest system by which advances of money are made to farmers is probably that which was established as early as 1770 by the German "Landschaften Bank"; and the principle, assuming different forms according to the circumstances of the countries into which it was introduced, was gradually extended to the other great countries of Europe, with the exception of the United Kingdom, where an unwieldy system of land transfer, and the growing accumulation of large estates, form obstacles in the way of its successful application. Since 1849, mainly by the efforts of Raiffeisen, the German Land Credit Banks have taken the form of purely co-operative institutions, and in this respect they have been followed by Sweden, the Baltic provinces of Russia, and Poland, as well as to some extent by Austria-Hungary; but in most of the European countries the institutions may be classed as partly State and partly Co-operative. In France alone is the system exclusively administered by the State; and it is the French *Crédit Foncier* which has been adopted in Australasia wherever the idea of rendering financial aid to agriculturists has been carried into effect, namely, in the Colonies of New South Wales, Victoria, South Australia, Western Australia, and New Zealand; while in Queensland and Tasmania the system has received consideration.

Encyclopædia Britannica.—Ninth Edition.

Art.—"*Crédit Foncier and Crédit Mobilier*," Vol. VI., p. 557.

Crédit Foncier and *Crédit Mobilier* are finance institutions, which had their origin in the joint-stock speculation and sanguine promotion of public works which marked many years of the second empire in France, and to which the introduction of limited liability in England had given a great stimulus on the British side of the Channel. The parent institutions in Paris were followed by similar establishments in some other capitals. As the terms imply, the *crédit foncier* contemplates loans and advances on real securities, and the *crédit mobilier* on what is called with us personal or movable estate. Whether such limits and distinctions have been ever strictly observed in the practical working of these credit banks is doubtful. The *crédit mobilier* of France has had a more unfortunate experience than the *crédit foncier*, though the latter has by no means sustained the promise of its early years. While the mania of launching new projects continued, enormous profits were made, which could only be the result of heavy promotion charges, and the shares rose in value with the extraordinary liberality of the dividends. But the system of business pursued had the result of mixing the credit banks very closely with the various companies and undertakings they were promoting, and of throwing back upon them a growing mass of depreciated and unsaleable securities; while the abatement or collapse of speculation restricted the business from which the main part of the former income had been derived. The rates of dividend and the value of the shares consequently fell as rapidly as they had risen. This has been the practical experience of the *crédit foncier* and the *crédit mobilier* of France, which were the first and remain the greatest of the finance companies so named. The *crédit foncier* of England (there has been no *crédit mobilier* in London) has had much the same course as the French companies; large profits for a few years were followed by increasing difficulties and the locking up of large amounts of capital in hopeless undertakings. The Imperial Land Company of Marseilles has absorbed £260,000, the Santiago and Carril Railway £193,000, and both are failures. The directors, in these circumstances, have been applying the annual profits to a reserve fund, and addressing themselves to a class of loans and advances on securities differing little from that of ordinary bankers, and many finance companies under various names.

Webster's International Dictionary.

Crédit foncier, a company licensed for the purpose of carrying out improvements by means of loans and advances upon real securities.

The following letter on the subject recently appeared in the columns of the *West Australian*:—

Able to buy £100 worth of machinery or stock, with £3 in cash; able to change a mortgage, bearing interest at 8 per cent. or 10 per cent., for one bearing only 4½ per cent., and 1½ per cent. sinking fund, with no danger of foreclosure. These are some of the benefits which Victorian farmers have obtained from the Credit Foncier System. Let all our farmers consider how much they would benefit by a similar improvement in our present Agricultural Bank. Better still, let all their friends, if they have any, in Parliament and elsewhere, consider how much it would do for the industry which they are fond of calling "the backbone of the country." That industry greatly needs such aid, if it is to compare favourably with other callings. Our present Land Bank is an excellent institution for helping the new settler, who has all his work before him, but its usefulness is confined to that limit by the regulations which bind the action of the manager. These rules only allow advances to be made for half the value of the work which the borrower proposes to do, and so practically forbid loans on the security of properties already improved. The actual payments are made in instalments as the work progresses, a method well suited to ordinary contracts, but most unsatisfactory in farming. The excellent work which the bank has already done under the restrictions which hamper its action is a proof that, with wider powers, its usefulness would be immensely increased. The great hindrance to the farmers' progress is that the credit system on which all other business is carried on, and which is called "the life of trade," is actually reversed in his case. The merchant, storekeeper, and manufacturer obtain nearly all their goods on credit, and often sell the greater part at a profit before repayment becomes due. Even when less fortunate, they can always get advances on their goods on reasonable terms. The farmer, on the contrary, has to pay in advance, months beforehand, in seed, labour, and manure, for the crops which he may not be able to sell for some time after they have been reaped. Ordinary short loans, bills at three months, are little use to him, as his returns come in so slowly. His case is, therefore particularly hard. It is difficult for him to obtain working capital by mortgaging his farm, even at high rates of interest, for the banks do not care to invest on a security unless it can be realised at short notice, "a liquid security," as it is called, and they are, no doubt, wise. Such being the case, the banks will have little reason for protesting against a liberal system of Government loans to farmers, on the ground that it would interfere with their legitimate business. It is scarcely likely, indeed, that they will care to protest, as in this progressive country they have so many better and more profitable fields for investment. The Credit Foncier System was devised with the aim of meeting these various difficulties, and was adopted in Victoria for the purpose of supplying farmers with financial assistance, which they could not obtain in any other way, so that they might, with its help, meet and overcome the disadvantages peculiar to their business. By the Savings Bank Act, of December, 1896, the Commissioners of the Savings Bank were empowered to make loans to farmers at 4½ per cent. interest, in sums of not less than £50, nor more than £2,000. The necessary funds are raised by the sale of mortgage bonds bearing 3½ per cent. interest, issued by the advances department of the Savings Bank, and secured on the revenue. The bonds are issued for sums of £25, and are sold both to the public and the Savings Bank itself. The latter takes about three-quarters of all issued to date, and is thus able to find a ready and profitable investment for the deposits which have accumulated in its hands. As it receives 3 per cent. on the bonds from the advances department, which has separate accounts, and pays only 2 per cent. or 2½ per cent. to its depositors, the difference gives it a profit. Then, again, the advances department, which lends to the farmers the money received from the sale of the bonds, charges them 4½ per cent. for it. The system thus pays its own expenses, and makes a profit besides, while avoiding the necessity of raising a loan on the money market in the usual

way. The small sum (£25) for which each bond is issued, makes them an excellent investment for the thrifty folk who have savings to invest, and desire a security which can be realised at any time. The loans are made in either cash or bonds, at the option of the borrower. In the latter case, he draws interest on the money until he requires to use it. The conditions laid down by the Act require that no loan shall exceed two-thirds the value of the property on which it is lent, and this amount is fixed by valuators appointed by the Commissioners. The security must always be freehold or Crown leasehold. In fixing the value of a leasehold, the estimated two-thirds is reduced by the sum of the rents still to be paid to make it freehold, unless improvements exist which make the property worth at least £2 per acre. The valuation costs from 50s. to £5, according to the distance of the property from the nearest railway station, but no legal charges are made. Buildings must be insured, and the policy and premium receipts lodged with the Commissioners. A noteworthy condition is that all applications for sums of less than £500 shall have priority over those for larger amounts. The valuers must carefully estimate the clear rental value of the property in average seasons and markets, and must allow for risks and depreciation through cropping the soil without proper manuring. They are not allowed to fix the value of land at more than 20 times its clear annual value if it is a farm, nor at more than 25 times the same if it is a pastoral property. The repayment of the loan is secured by a charge of not less than 1½ per cent. per annum, in addition to the interest at 4½ per cent. This will pay off the whole loan in 31½ years, but higher rates may be arranged which will repay it in less time, while the whole amount may be paid at any time the borrower wishes to clear off his liability. Land which is cultivated as a vinyard or orchard, and has thus acquired a special increase of value, is allowed an extra advance of not more than £7 10s. per acre, in addition to the two-thirds of its value as farm or pastoral land. Loans on this class of property must be repaid in 15 years by annual instalments of 5 per cent. All repayments, with interest, are made half-yearly. The money lent on any property may be used to pay off liabilities already existing on it, to pay money rents owing to the Crown, to make improvements, or to enable the borrower to carry on his business as a farmer, fruitgrower, or pastoralist. The first and last conditions are especially interesting, and the importance of the first is shown by the fact that out of £1,163,000 advanced to farmers up to June 30 last, the immense amount of £1,038,000 was used for this purpose. Of the balance, £51,000 was used in paying Crown rents, and the remainder, about £72,000 "in making improvements, developing resources, and carrying on." During the first 18 months from the passing of the Act, the number of applications averaged 26 per week, and increased for another year, until the number of loans granted reached just over two thousand, averaging £449 each, thus showing the need for the system, and the appreciation it met with. Since that date—two years previous to the last report—the number of applications decreased regularly to about 850 per year, and the average of the loans has risen to £500, which proves that the Act has fulfilled the design of its promoters. The total loss up to the date of the last report, that is, for the four and a-half years covered by the Act, was only £33 14s. 9d., while the net profit for the last year alone was £7,767. The system has, therefore, proved an all round success. The farmers who were formerly paying 8 and 10 per cent. on their mortgages in interest alone are now required to pay only 6 per cent., and this not only pays the interest, but also reduces the principal, until it is all redeemed. Others, who could not, or dared not, borrow in the ordinary way, were able to obtain the capital they needed for trading or improvements, with the certainty that while they kept up the moderate payments required they were safe against foreclosure. The importance of this last condition can only be realised fully by those who have had experience in farming. The long time required for improvements to become payable, often two or three years, puts the ordinary systems beyond the reach of farmers. Even when profits do begin to come in, they are generally so small as to make it difficult or impossible to reduce the principal

while paying the ordinary rates of interest. When we compare the state of farming in Victoria five years ago with what it is now, the results of the Credit Foncier System are clearly shown. Business was then wretchedly bad, work on the land was difficult to get at even 10s. per week, and in Melbourne, mechanics received only £1 per week. Hundreds of farmers left for this State and New South Wales, and thousands of their men followed them. Now trade has recovered, wages have risen, and the whole country is prosperous. This change is very largely due to the statesmanlike action of the Parliament in passing the Credit Foncier Act. The immediate result of the Act has been to transfer some of the surplus capital hoarded in the Savings Bank, from the city, where it was not required, to the country, where it found profitable investment. It stimulated enterprise, and so made work plentiful, and restored the prosperity of the country. This State would benefit very greatly by the introduction of the same system, for the greatest obstacle to the progress of farming is the want of capital for developing the resources of the land and for purchasing stock. Hundreds of farmers have well-grassed paddocks which are useless, because they cannot buy the stock which would fatten in them, and the whole community is crying out for cheaper meat. If farmers could pledge their improved holdings to the State for capital which would buy the stock, this complaint would soon cease. In the case of a farmer buying a flock of sheep, the wool would pay interest and sinking fund, if not more, while the increased numbers of a breeding flock, and the value of a fattening one would ensure him a profit. Others would be able to make improvements, which would not only increase the permanent wealth of the community, but also give employment to hundreds of men. The Credit Foncier System would provide the capital for both these developments, and no other could do it so easily and cheaply. It would find a profitable investment for the funds of the Savings Bank, and the State would no longer have to pay interest on them as it does now. The farmers would do that. No loan would have to be raised, and no expense would fall on the State, for the system would pay its own expenses, and make a profit as well.—Yours, etc., J. M. WHISTLER, Secretary of the Country Progress Party. Boyanup, January 8.

WANNEROO FARMERS' AND GARDENERS' ASSOCIATION.

MEETING OF SOCIETY.

The following report of the regular monthly meeting of the above Society has been forwarded by the Secretary, Mr. Chas. A. Shaw:—A meeting of the above Society was held in the State school room on 21st December, 1901. The President (Mr. H. Hocking) was in the chair. A letter was received from Mr. A. Sanderson, Secretary Darling Range Vine and Fruitgrowers' Association *re* the National Show; it was decided to ask Mr. Sanderson to attend our next meeting, on the 25th of January. After other correspondence had been read and accounts passed, it was decided that Mr. Jacoby, M.L.A., be invited to our next meeting, so that we might lay before him more fully our requirements; that

the Agricultural Department be asked to publish a report of our meetings in the "Journal," and that a report be sent to each of the morning daily papers. A resolution was passed that the notice of the member for Swan and also the Trades and Labour Council be drawn to sections 84, 148, and 149 of the 1900 Land Act; also a new section might be introduced with advantage, allowing improvements on homesteads or conditional purchases over the required amount to go towards improvements on other C.P. blocks not adjoining, but within five miles, with the exception of the boundary fence, which must be done in any case. A discussion then ensued *re* the cheapening of artificial manures, but it was eventually decided to postpone the subject till next meeting. Four new members joined; the meeting then closed.

THE FRENCH STALLION DEPOTS.

The annual report of the director of the French stallion depôts states that the number of horses in the twenty-two different depôts on 11th January was 3,087, of which 266 were thoroughbreds, 103 Arabs, 258 Anglo-Arabs, 2,003 half-breds, and 457 heavy draught horses; the half-breds being classed as Norman and Vendean breed (1,398), 275 trotters, 167 Southern breeds, and 163 Norfolk trotters. These stallions covered 165,704 mares, of which 3,122 were thoroughbreds and Arabs, 102,672 half-breds, and 59,910 heavy draught mares, the fees received for covering these mares being £49,790. The patent of approval was granted by the Government to 1,404 other stallions, which received premiums worth about £28,000, and covered 69,110 mares. In addition, 214 stallions were "authorised," and covered 8,652 mares, so that, putting these figures together, it will be seen that 243,166 mares were covered by stallions which may be said to have received the patent of the Government. A sum of £57,000 was spent in premiums at shows to stallions, mares, and their produce. If to this total is added the sum of £60,000, given to the different races, the sum spent by the State in encouraging horse-breeding in France last year was rather over £70,000. The director of the Haras concludes his report by saying that "the Exhibition of 1900 set its seal upon the success of the efforts made during the last thirty years to improve our national breeds, which are well suited to all the requirements of the country and the army. The Minister of Agriculture was well warranted in his statement that the French cavalry might serve as a model for all the cavalries of Europe."

GARDEN NOTES FOR JANUARY.

PERCY G. WICKEN.

The long run of cool weather experienced during the past month will have the effect of keeping the soil in a moister condition than is usual at this time of the year, and will assist vegetables in making a good growth. In the South-West and coastal districts all summer crops are making rapid growth, and promise to yield good crops; further inland, as we reach the drier and warmer districts, the effects of the dry weather are more severely felt. It is of very little use to plant seeds in places where the ground is very dry, and if the ground contains only just sufficient moisture to cause the seed to shoot and not enough to allow it to grow, the young shoot dies off before appearing above the ground, and the seed is a failure, as when it has once germinated it is useless. If the seed is planted when the ground is too dry to allow germination, the seed will remain in the ground until the first rainfall, and then come up. Attention should be given to all growing crops and care taken to keep all weeds cut down, as they are the means of taking moisture from the soil, all of which is much needed by the growing crop. The surface soil should also be kept well stirred so as to retain all possible moisture in the ground. Where a plentiful supply of stable manure has been dug into the ground, this will be of great assistance in keeping the soil in a moist condition.

A good mulching is a great help during the next few months. Almost any substance that will rot may be used for a mulching—stable manure, dead leaves, straw, rakings from the bush, winnowings from the wheat, dead weeds, etc. At the end of the dry weather this material may be dug into the ground, and will act as a manure for the following crop. The noxious weed, stinkwort, is again troublesome. Under the provisions of the Noxious Weeds Act, the destruction of this pest is compulsory, and neglect to do so is punishable by a fine. Landowners, however, should not wait until they receive a visit from an inspector to compel them to cut down the weed, but in their own interests should look out for it and cut it down as soon as they can find any plants showing. This Act was passed for the benefit of settlers only, as, if the weed is allowed to grow unchecked, it will speedily render useless large areas of country. It takes complete possession of the soil to the exclusion of all other vegetation.

The National Show is again to be held in Perth on 5th March, and all those having good specimens of fruit or vegetables should at once forward them to the Government Refrigerating Works, where they will be stored free of charge until show time. Labels for the purpose can be obtained from the secretaries of all local agricultural societies, and also from the Secretary, Department of Agriculture.

French Beans.—This is about the best vegetable to plant during the hottest part of the year, and where there is sufficient moisture in the soil, a supply may be planted.

Madagascar Bean.—These should now be coming into bearing. The beans grow in clusters. They should be picked when young, cut into slices, and cooked the same way as French beans, the whole pod being used.

Lima Beans.—Early varieties should now be bearing. The beans are shelled and cooked the same as peas, and, with a little butter over them, are one of the most delicious vegetables to be obtained. The dried bean may also be used the same as haricot beans.

Cabbages and Cauliflowers.—Seed beds may be made so as to have plants ready for early planting; the land can also be broken up and prepared ready for sowing after the first rain.

Melons.—It is now too late for planting with any hope of success. It is a good plan to go round the bed when the melons are getting ripe and pick out the best and those true to name, and mark them with a knife so that they can be reserved for seed purposes for the following season.

Maize may be sown for green feed, but it is too late to sow for grain

Pumpkins.—Early varieties of pumpkins and squashes will now be ready for market. All sound ones should be stored away for future use; they will keep in a well-ventilated store. Keep a few large ones for the National Show.

Sorghum can be sown anywhere where there is sufficient moisture to allow the seed to grow, and will furnish a good supply of green feed. Care must be taken not to allow any stock to get at a growth of immature sorghum, or the result is likely to be fatal.

Sweet Potatoes.—Will require hilling up, if not already done, and weeds must be kept down between the rows.

Tomatoes.—This fruit is now becoming plentiful in the market. More plants should be put out, if available. To keep up a supply the plants will require shading. Should any black spot or other fungus disease appear, the fruit should be pulled off and burnt, so as to prevent the disease from spreading. If diseased fruit is allowed to rot on the ground, it is only a means of spreading the disease. Spraying with Bordeaux mixture is one of the best preventatives.

Turnips.—Towards the end of the month a number of early varieties of turnips may be planted, and, if properly cultivated, should do well. Superphosphate is the best manure to apply to this crop.

Farm.—In the earlier districts harvesting will be over, but in other parts the stripper and reaper and binder will be in full swing, and little time exists for other work. The risk of fire is now very

great, and care should be taken to plough fire breaks round all stacks and sheds. It is very little trouble, and lessens the risk considerably. Wherever the ground is moist enough, a crop of cow pea should be planted and turned in for green manure. It will greatly improve the soil, and also increase the yield of the following crop to a marked degree. The land should be ploughed as soon as it is possible to do so, and allowed to lie fallow until time for planting the next crop.

The bot fly is again troublesome, and causing much mortality among horses. When a horse is attacked by bots, the treatment is a subject for the veterinary surgeon. Prevention is better than cure, and a few notes on the life history of the bot fly may be of interest.

The fly lays the eggs on the hairs of the animal, which are licked off and carried into the mouth, thence into the stomach; thence they also work their way through the tissue to a point immediately beneath the skin, where they form a marble or lump from which the fly makes its escape through the skin, leaving behind an ulcerated fester.

The eggs, when laid on the hairs of the animal, can be easily detected, being generally on the jaws and shoulders, and they can be removed by thoroughly grooming the horse, and also by being rubbed with carbolised oil or washed with carbolic soap.

MARKET REPORT.

For Month ending 8th January, 1902.

Messrs. A. L. Ballantyne & Co., Produce Merchants and Commission Agents, City Markets, Perth, report sales in undermentioned lines for month ending 8th January, 1902:—

Farm Produce.—Chaff has been forwarded in large quantities during the month, new season's crop arriving in first-class order. Buyers prefer new chaff for feed. We sold trucks from £3 10s. to £4 7s. 6d. per ton. A special line of oaten chaff realised £4 10s. per ton. Old chaff has been very hard to move. Bran and pollard have had good clearances at £6 12s. 6d. and £6 15s. per ton respectively. Market inclined to harden. Maize, 4s. 9d. per bushel. Prussian blue peas, 6s. per bushel. Wheat, quantity new season, now being offered at 3s. 10d. to 4s. per bushel; prime old wheat 4s. 3d. to 4s. 5d. per bushel. Oats, several lines new Algerian oats realised 3s. 4d. to 3s. 6d. per bushel. New Zealand oats, 4s. per bushel. Flour, local, £9 10s. per ton, with weaker feeling for forward delivery. Imported flour firmer, in sympathy with increased prices ruling in Eastern States. Onions, large quantities have been imported during past month. Prices receded to £6 10s. per ton. Eastern markets now firmer, with upward tendency. Potatoes: farmers have been able to keep this market fully supplied this season up to this point, but stocks are apparently exhausted, and as those

from Eastern States are too green to import on a large scale, prices have firmed considerably. Prices for past month have averaged £7 per ton; value at present, £8 to £9. Values will soon settle lower.

Dairy Produce.—It is surprising the small quantity of this line produced, considering the consistent demand and satisfactory prices obtained. Local butter, 1s. 1d. to 1s. 3d. per lb. for prime quality. Imported butter, 1s. 0½d. to 1s. 2d. per lb. for best quality. Inferior lines, 11½d. to 1s. per lb. Bacon, market bare. Prime quality, 10½d. to 11½d. per lb. for Victorian sides. Hams: there was keen demand for this line during the holidays; market very bare at present. Prime quality, 1s. 0½d. to 1s. 2d. per lb.; other lines, 10d. to 1s. per lb. Honey, 12s. 6d. to 15s. per 60lb. tin. Section honey, 8s. per dozen. Eggs, good demand for local eggs, 1s. 9d. to 1s. 10d. per dozen. Imported, 1s. to 1s. 0½d. per dozen.

Fruit.—There has been a great quantity of local fruit offered this season, prices for which have been very satisfactory. Apples, only local crop offered so far, best quality, 24s. to 25s. per case. Cooking apples, 10s. to 12s. per case. Pears, 10s. to 12s. 6d. per case. Figs, 4d. to 9d. per dozen. Apricots, 14s. to 24s. per case. Peaches, 17s. to 31s. per case. Nectarines, 12s. to 14s. per case. Oranges, only Italian offering, 22s. to 23s. per case. Lemons, Italian, 21s. to 22s. per case. Tomatoes, ripe, lots 2s. 6d. to 5s. per case. Green tomatoes, 5s. to 6s. 6d. per case. Strawberries, the Darling Range Association have finished the season with satisfactory results, prices ruling, 9d. per lb., 10d. to 10½d. per lb. for special lines. Cape gooseberries, 2d. to 2½d. per lb. Grapes, few now offering, 10s. to 12s. per case.

Vegetables.—Supplies have been liberal, prices moderate, except during the holidays, when green peas and French beans brought 3d. to 4d. per lb. over ruling rates. Cabbage, 5s. to 6s. per cwt. Beans, 2d. to 3d. per lb. Peas, 2d. to 2½d. per lb. Cucumber, 6d. to 1s. per doz. Marrows, 2s. 6d. per doz. Turnips, carrots, and raddish, 1s. 3d. per doz. bunches. Lettuce, 9d. per dozen bunches. Rhubarb, 2d. to 2½d. per lb.

Poultry.—Large quantities were offered before Christmas, which realised satisfactory prices. Prices since holidays have come back slightly, but market is bare. Table fowls, 6s. 6d. to 7s. 6d. per pair. Hens, 6s. to 7s. per pair. Ducks, 6s. 6d. to 7s. 6d. per pair. Ducklings, 5s. to 6s. 6d. per pair. Turkeys, 24s. to 30s. per pair. Geese, 12s. to 16s. per pair.

Live Stock and Carcase Meat.—Pigs, large quantities have been forwarded past month, prices as follow:—Prime porkers, 30s. to 35s. each. Forward stores, 24s. to 28s. each. Backward stores, 12s. to 21s. each. Sucking pigs, 6s. to 8s. each. Carcase pork, 6d. to 6¾d. per lb. Lambs, 8s. to 9s. each. Mutton, 4½d. per lb. Vealers, 5d. per lb.

SECOND

NATIONAL SHOW OF PRODUCE.

IN order to show the great progress made in Agriculture during recent years, it has been decided by the Hon. Minister for Lands to again hold a National Show in Perth next March. Prizes are to be given for the best collection of farm produce exhibited by groups of Agricultural Societies, and also for the best exhibits of manufactured articles made from locally grown products.

1. CHAMPION PRIZE.

(DISTRICT EXHIBIT.)

Best collection of Farm, Garden, and Orchard produce, comprising everything grown, produced, and made on a farm. First prize, £40; second prize, £20; third prize, £10.

The exhibit to be collected by the Agricultural Societies from produce grown within the boundaries of their respective districts, as defined on pages 433 to 435, and to be displayed by them. Should they be called upon to do so by the Judges, the Secretaries of the Societies, or the person placed in charge of the exhibits, shall make a declaration that all the exhibits have been grown or produced within their respective districts.

In order to encourage individuals to contribute to the district collection, first, second, and third class certificates of merit will be issued by the Department for the best exhibits in each class. For this purpose the exhibits in the district collections may be labelled with the name (or number) of the grower.

The certificates will be given for the best exhibits in each class, irrespective of the district, such as the best pumpkins, best sample of wheat, etc., and need not necessarily be contained in the best district collection.

The prize money will be paid by the Department to whomsoever the Societies nominate to receive it, but this nomination must be sent to the Secretary, with the detailed entries, not later than 1st February.

The medals and certificates will be distributed per medium of the Agricultural Societies.

MANUFACTURED GOODS.

EDIBLE.

Class 2. Best exhibit of—

A. Jams and Preserves.
B. Sauces and Pickles.
C. Flour.
D. Wine.
E. Honey and Bee Products.
F. Butter.
G. Bacon.
H. Miscellaneous.

First prize, silver medal; second and third class certificates.

NON-EDIBLE.

Class 3. Best exhibit of—

Manufactured from produce of West Australian soil (minerals excluded).

A. Articles manufactured from local timber.
B. Brushware.
C. Fruit cases and shooks.
D. Soap and Candles.
E. Miscellaneous.

First prize, silver medal; second and third class certificates.

POULTRY APPLIANCES.

Class 4. Best collection of Poultry-keeping Appliances. First prize, certificate; second prize certificate.

BEE APPLIANCES.

Class 5. Best collection of Bee-keeping Appliances First prize, certificate; second prize, certificate.

SPRAYING APPARATUS.

Class 6. Best collection of Spraying Apparatus. First prize certificate; second prize, certificate.

MANURES.

Class 7. Best collection of Manures, to be in stoppered bottles, to contain about 7lbs. each, with analysis attached. First prize, certificate; second prize, certificate.

CLASSES 2 AND 3.—The articles to be manufactured by the exhibitor or through the agency of the firms competing. Should they be required to do so by the Judges, the exhibitor, or in the case of a firm, the manager, shall make a declaration that all the articles have been made by himself, or his firm, from agricultural produce raised in West Australia.

BOTANICAL.

Poison Plants.

Class 8. Best collection of West Australian Poison Plants. (Pressed.) First prize, certificate; second prize, certificate.

Native Grasses.

Class 9. Best collection of native Grasses. (Pressed.) First prize, certificate; second prize, certificate.

Saltbushes.

Class 10. Best collection of native Saltbushes. (Pressed.) First prize, certificate; second prize, certificate.

Fodder Plants.

Class 11. Best collection of native Fodder Plants, not including grasses. (Pressed.) First prize, certificate; second prize, certificate.

WOOL.

Class 12. Best three fleeces of—

A. Merino ewe's wool.
B. Merino ram's wool.
C. Merino lamb's wool.
D. Shropshire Down wool.
E. Long-wool sheep.
F. Cross-bred sheep.

The breed of the sheep, sex and age, and the number of days' growth of wool to be stated in each case. First prize, silver medal; second prize, certificate.

Railway freights from station of departure to Perth will be defrayed by the Department on all produce sent by the Agricultural Societies for competition, but no return freights will be paid on unsold exhibits. The Department will receive and store exhibits at Perth if duly notified beforehand, and will take every care, but will not accept any risk. The Secretary of the Department of Agriculture reserves the right of rejecting any exhibit not considered suitable. All exhibits must be addressed as follows. (Proper labels will be supplied free if application is made to the Secretary of the Department of Agriculture, Perth) :—

National Show, 1902.

To the Manager, Government Refrigerating Works (Siding), Perth.

From—

Name in full...

Address...

Nature of contents to be fully specified, giving name, variety, and date of packing if fruit or other perishable produce ....
....
....

All table and necessary accommodation for the display of exhibits will be provided free of charge, but all exhibits must be displayed by the competitors at their own expense in the space allotted for that purpose by the Department. A limited number of free railway passes (return) will be granted to each district exhibiting, to enable representatives to attend and arrange their respective courts.

To encourage country societies to make a good exhibit of perishable produce, a certain space, if available, in the Government Refrigerating Stores will be set apart for the purpose of keeping perishable products, and on each district notifying their intention of competing, a reasonable amount of exhibits will be stored for them *free of charge*, the Secretary, Department of Agriculture, reserving the right of limiting or rejecting any exhibit which, in his opinion, may not be worth the expense of cold storage.

Societies will be allowed to exhibit a reasonable number of bags of grain, or other heavy produce, such as potatoes, roots, etc., and can collect from the farmers of their district, but will be limited to one bag from each farmer of each class of grain. The Department will not pay freight on more than one ton of flour from any one mill.

All Societies intending to exhibit must notify the Secretary, Department of Agriculture, by December 1st, as to their intention to exhibit, so as to enable arrangements to be made for a hall, and all entries in detail must be in the hands of the Secretary by February 1st, 1902.

The decision of the Judge or Judges to be final.

For the purposes of the competition for the Champion prize, the State has been divided into 15 districts, and the societies within each district should combine together and make one large exhibit. Each exhibit will be placarded Blackwood, Beverley, Northam, etc., as the case may be. A list of the Societies in each district is appended.

Efforts will be made to arrange excursion trains from the country, so that all may see the exhibition.

A sale of produce will be arranged by the Government auctioneer after the exhibition, and anyone desiring to sell their exhibits may do so by paying the auctioneer's commission. The Department will not be in any way responsible for the exhibits after the close of the exhibition, nor for the sale or collection of money for which exhibits may have been sold.

On no account must perishable produce be packed with other classes of exhibits.

The co-operation of all societies is invited so as to make a good show, and thereby to stimulate the demand for West Australian produce.

All exhibits must be forwarded so as to arrive at the Hall by 6 p.m. on the day previous to the show.

Any further particulars can be obtained on application to the Secretary, Department of Agriculture.

List of Exhibits which it is Suggested might be Collected by the Societies Competing for the Champion Prize :—

Collection of Grains.—Wheat, Oats, Barley, Rye, Maize, etc.

Collection of all Kinds of Seeds :—

Beans and Peas, Cow Pea, etc., both as green feed, hay and seed.

Rock, Preserving, and Water Melons, Pumpkins, Marrows, Squashes, Cucumbers, etc.

Root Crops.—Sugar Beets, Turnips, Swedes, Kohl Rabi, Mangels, Potatoes, Sweet Potatoes, Yams.

Hay and Chaff.—Lucerne, Wheaten, Oaten, Millet, Grass, Mixed, both bale and sheaf.

Ensilage.—Sweet and sour, chaffed and whole.

Fodder.—Sorghums, Millets, Lucerne, Green Maize, Teosinte, Tree Lucerne, Lupins, Cabbage, Kale, Rape, Mustard.

Miscellaneous Crops.—Buckwheat, Ramie, Jute, Broom Millet, Peanuts, Arrowroot, Indigo, Sunflower, Cassava, Tumeric, Tobacco, etc., etc.

Vegetables.—Cabbage, Beans, Peas, Tomatoes, Asparagus, Cauliflower, Chilies, Leeks, Parsnips, Carrots, Rhubarb, Turnips, etc.

Fruit and Grapes of all kinds, both fresh, dried, and preserved.

Honey, Eggs, Butter, Cheese, Bacon, Lard.

Home Made Jams, Jellies, Pickles, Vinegar, Wine, Bottled Fruits, Sauces, Arrowroot, Millet Brooms, Fibre, Tobacco, Candied Peel.

List of Exhibits which it is Suggested might be Collected by Firms Competing for the Prizes for Edible Products.

Collections of Jams, Jellies, Sauces, bottled: tinned and dried Fruits, Vinegar, Candied Peel, Wines, Arrowroot, Tapioca, Butter, Cheese, Bacon, Ham, Lard, Honey, Wax, Bread, Maize Meal, Oatmeal.

List of Exhibits which it is Suggested might be Collected by Firms Competing for the Prizes for Non-Edible Products.

Collection of articles made from local Timbers, Handles for Tools, etc.; Brooms and Brushes made from Millet and Fibres, collection of Fibres; Gums, Resins, Tobacco, Dyes, Oils, Leather, Wool, Basil, Cotton, Soap, Candles, etc.

For the purpose of the Exhibition, Societies are divided into districts, as follows :—

Blackwood.

Balingup Farmers' Association.
Lower Blackwood Farmers' and Graziers' Association.

Nelson Agricultural Society.
Upper Blackwood Agricultural Society.
Boyup Brook Agricultural and Vigilance Committee.

Fremantle.

Coogee Agricultural and Horticultural Society.
Jandakot Agricultural Society.
Walliabup Progress and Horticultural Society.

Murray.

Armadale Progress Association.
Drakesbrook Agricultural Association.
Murray Horticultural Society.
Murray District Farmers' and Fruitgrowers' Co-operative Association.
Waigerup Agricultural Hall Association.
West Coolup Agricultural Society.
Jarrahdale District Agricultural Society.
Kelmscott Horticultural and Agricultural Society.

Plantagenet.

Albany and King's River Settlers' Association.
Albany Agricultural and Horticultural Society.
Albany and District Settlers' Association.
Mt. Barker District Settlers' Association.

Esperance.

Esperance Agricultural and Horticultural Society.

Sussex.

Newtown Farmers' Progress Association.
Quindalup Progress Association.
Southern Districts Agricultural Society.
Wonnerup Progress Association.

Swan.

Darling Range Vine and Fruitgrowers' Association.
Wanneroo Farmers' and Gardeners' Association.

Toodyay.

Deepdale Farmers' and Fruitgrowers' Association.
Moora Farmers' and Progress Association.
Newcastle Branch Bureau.
Toodyay Agricultural Society.
Toodyay Vine and Fruitgrowers' Association.
Victoria Plains Farmers' Association.

Northam.

Goomalling Farmers' Club.
Greenhills Farmers' Club.
Jennapullen Agricultural Society.

Jurakine Agricultural Association.
Northam Agricultural Society.
Wongamine Farmers' Club.

VICTORIA.

Greenough Farmers' Club.
Greenough Farmers' Association.
Geraldton Agricultural and Horticultural Society.
Irwin Agricultural Society.
Chapman Farmers' Association.
Upper Chapman Farmers' and Fruitgrowers' Association.

WELLINGTON.

Capel Farmers' Association.
Brunswick Farmers' Club.
Harvey Farmers' Club.
Harvey Agricultural Alliance.
Boyanup Farmers' and Progress Association.
Cookernup Farmers' Progress Association
Donnybrook Progress Association.
Ferguson Farmers' Association.
Preston Progress Association.
Thomson's Brook Progress Association.
Wellington Pastoral and Agricultural Society.
Waterloo Farmers' Protection Association.

WILLIAMS.

Kojonup Agricultural and Horticultural Society.
Wandering District Agricultural Society.
Williams Agricultural Society.

GREAT SOUTHERN RAILWAY.

Great Southern Pastoral and Agricultural Society.
Narrogin Agricultural Alliance.
Wagin and Arthur District Agricultural, Horticultural, and Industrial Society.
Marbellup and District Settlers' Association.

YORK.

York Agricultural Society.

BEVERLEY.

Beverley Agricultural Society.
Pingelly and Moorambine Agricultural Society.

THE CLIMATE OF WESTERN AUSTRALIA DURING DECEMBER, 1901.

The condition of the atmosphere has now settled down into a distinctly summer type, with low pressure inland and high off the West and South coast. The mean barometers for the month are on the whole in remarkably close agreement with the averages for previous years. The temperature also, on the whole, was about normal, with the exception of a narrow strip along the West coast from Onslow to Cape Leeuwin, where it was below the average. The prevailing impression of an altogether remarkably cool month in Perth was unsupported by facts. It is very curious that as every year comes round one finds a general expression of wonder and thankfulness with regard to the mildness of the current summer in Perth, especially about the end of December.

In the present instance the mean daily maximum at the Perth Gardens was 82·6. This is only 0·4 below the average since 1886, when the thermometers were installed in their present position, and during these 15 years the mean has been as low or lower on seven occasions; so this December must be considered a normal one, as far as Perth is concerned.

The effect of the sea breeze in tempering the climate during the day time is very pronounced. Thus, on an approximate East and West line, the mean maximum from the coast inwards is:

Fremantle	73·8
Perth Observatory	77·8
Perth Gardens	82·6
Guildford	82·5
York	87·7
Southern Cross	94·2
Coolgardie	93·2

On the coast it is rather curious to observe that the days were cooler at Fremantle than at any other place from Busselton Northward, but this may possibly be due to the fact that at Fremantle the thermometers are exposed very close to the shore line, or it may be due to some exceptionally favourable circumstances during this particular month. At night time the coolest reporting stations were Bridgetown and Wandering, where the mean night temperature was 10 degrees below that for Perth, and the thermometer at Bridgetown was on one occasion within four degrees of the freezing point.

The direct opposite of this occurred in the tropical interior. Instruments have only recently been mounted at Marble Bar, so it is not known whether the heat was exceptional or not this month, but the mean maximum was 109·1, and the highest recorded temperature 118·8. The mean minimum there was 79·2, and the lowest registered at any time during the month 71·6.

The rainfall throughout, except in the extreme South, was light, and below the average for previous years.

The Climate of Western Australia during December, 1901.

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					December, 1901.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
NORTH-WEST AND NORTH COAST:															
Wyndham ...	29·789	29·780	29·933	29·634	100·4	81·8	91·1	109·5	70·2	100·1	80·4	113·0	68·0	247	2054
Derby	29·802	29·824	29·974	29·651	99·9	80·0	90·0	109·2	72·0	97·6	78·9	110·0	70·0	217	1374
Broome ...	29·807	29·827	29·956	29·696	95·3	82·9	89·1	107·0	72·0	94·0	79·3	108·9	69·0	179	3384
Condon ...	29·804	29·773	29·987	29·665	98·0	74·0	86·0	112·8	67·2	95·3	74·8	108·5	60·0	5	2450
Cossack ...	29·815	29·807	29·990	29·671	100·7	76·0	88·4	111·2	68·5	97·5	77·2	115·0	64·0	*Nil*	803
Onslow ...	29·860	29·844	29·986	29·668	95·9	68·4	82·2	108·2	60·2	97·9	68·7	121·0	53·0	9	259
Carnarvon ...	29·900	29·858	30·015	29·758	82·6	67·8	75·2	101·1	61·2	86·7	67·1	117·0	52·0	*Nil*	583
Hamelin Pool...	29·886	...	30·014	29·702	92·5	63·2	77·8	111·8	54·4	96·1	65·0	108·2	56·2	4	461
Geraldton ...	29·946	29·940	30·119	29·797	76·7	60·5	68·6	94·0	50·0	82·3	61·9	110·0	49·0	*Nil*	1848
INLAND:															
Hall's Creek ...	29·819	...	29·955	29·595	104·1	78·6	91·4	108·6	68·4	...	...	...	...	118	1769
Marble Bar ...	...	...	...	...	109·1	79·2	94·2	118·8	71·6	...	...	...	...	139	2183
Nullagine ...	29·745	...	29·922	29·543	106·4	72·6	89·5	113·0	64·0	...	...	...	...	119	2050
Peak Hill ...	29·762	...	29·964	29·501	99·9	74·2	87·0	108·0	63·4	...	...	...	...	17	774
Wiluna ...	...	...	...	...	101·0	71·9	86·4	110·0	61·9	...	...	...	...	9	765
Cue	29·823	29·815	30·029	29·568	99·7	68·0	83·8	110·5	58·0	99·0	70·1	112·0	50·5	9	481
Yalgoo ...	29·848	29·838	30·055	29·550	96·1	63·0	79·6	111·0	54·0	97·5	65·5	113·5	52·3	3	443
Lawlers ...	29·786	...	30·073	29·391	98·9	71·9	85·4	110·4	62·0	...	...	...	...	9	748
Laverton ...	29·822	...	30·130	29·452	97·5	69·3	83·4	108·6	60·0	...	...	...	...	54	758
Menzies ...	29·820	29·846	30·136	29·606	96·0	67·5	81·8	109·1	55·8	94·7	65·7	110·9	50·2	13	708
Kalgoorlie ...	29·860	29·892	30·181	29·470	93·5	64·2	78·8	107·8	53·1	92·3	62·3	110·0	49·0	22	803
Coolgardie ...	29·844	...	30·154	29·442	93·2	62·1	77·6	106·2	51·0	92·5	61·4	110·2	49·8	22	718
Southern Cross	29·838	29·881	30·106	29·545	94·2	61·2	77·2	109·8	50·1	93·6	60·0	113·0	47·4	3	738
Walebing ...	...	...	...	...	86·4	57·2	71·8	106·0	44·0	...	...	...	...	41	1657
Northam ...	...	...	...	...	84·2	58·1	71·2	106·4	44·1	...	...	...	...	5	1168
York	29·888	29·925	30·166	29·691	87·7	57·2	72·4	104·8	44·6	88·1	61·2	114·5	42·0	30	1316
Guildford ...	...	...	...	...	82·5	56·6	69·6	106·0	42·0	...	...	...	...	45	2912

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Climate of Western Australia during December, 1901—*continued.*

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					December, 1901.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan 1.
SOUTH-WEST AND SOUTH COAST.															
Perth Gardens	29·945	29·961	30·181	29·683	82·6	59·2	70·9	103·0	51·0	83·5	60·4	114·0	47·0	58	3584
Perth Observatory	29·952	29·968	30·180	29·711	77·8	59·0	68·4	101·4	50·7	81·1	60·6	102·8	49·2	52	3675
Fremantle ...	29·948	29·949	30·172	29·710	73·8	60·5	67·2	97·2	51·5	79·6	61·8	106·0	48·0	51	2815
Rottnest ...	29·946	29·931	30·182	29·699	73·9	60·7	67·3	103·0	51·0	78·3	59·9	102·5	46·0	29	2531
Mandurah ...	...	...	...	...	78·5	57·4	68·0	99·8	43·6	...	...	...	...	92	3129
Wandering ...	...	...	...	...	83·0	49·3	66·2	104·0	36·8	...	...	...	...	17	1857
Collie	...	...	...	...	79·5	50·3	64·9	99·0	39·5	...	...	...	...	105	3103
Donnybrook ...	...	...	...	...	78·8	50·5	64·6	96·5	41·0	...	...	...	...	137	3455
Bunbury ...	29·962	29·978	30·204	29·657	77·1	55·4	66·2	93·5	45·0	78·1	57·0	105·0	41·0	88	3388
Busselton ...	...	...	...	...	76·1	54·4	65·2	93·0	42·0	...	...	...	...	74	3071
Bridgetown ...	...	...	...	...	79·0	49·2	64·1	96·9	36·0	...	...	...	...	114	2980
Karridale ...	...	30·001	30·224	29·551	71·3	54·3	62·8	89·0	43·2	74·6	54·4	101·0	43·0	502	4950
Cape Leeuwin	29·950	29·978	30·249	29·428	69·1	59·2	64·2	75·0	55·8	72·1	60·1	98·4	53·0	375	3731
Katanning ...	29·914	29·945	30·215	29·597	83·0	52·9	68·0	104·2	41·5	84·2	52·8	105·8	41·0	61	1647
Albany ...	29·956	30·001	30·268	29·512	73·4	51·1	62·2	85·0	43·5	70·6	57·3	103·0	42·5	459	3066
Breaksea ...	29·941	...	30·332	29·515	68·0	58·0	63·0	79·5	52·2	68·4	57·2	94·0	46·0	319	2233
Esperance ...	29 924	29·990	30·265	29·565	78·7	58·6	68·6	99·5	46·0	77·4	58·1	108·0	42·0	48	2389
Balladonia ...	29·862	...	30·229	29·412	89·8	57·9	73·8	108·8	45·7	...	...	...	...	25	759
Eyre	29·914	...	30·207	29·534	79·5	58·9	69·2	108·0	40·5	...	...	...	...	8	1188

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Observatory, Perth,
8th January, 1902.

W. E. COOKE,
Government Astronomer.

RAINFALL for November, 1901 (completed as far as possible), and for December, 1901 (principally from Telegraphic Reports).

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
East Kimberley:				
Wyndham ...	432	...	247	...
6-Mile	510	5	188	6
The Stud Station	...	...	...	...
Carlton	342	9	99	9
Denham	...	...	...	...
Rosewood Downs	234	10	...	...
Argyle Downs ...	216	13	...	...
Lisadell	...	...	...	...
Turkey Creek ...	271	11	226	12
Plympton, St. Mary	...	...	...	...
Koojubrin ...	...	...	...	...
Hall's Creek ...	105	...	118	...
Flora Valley ...	...	...	...	...
Ruby Creek ...	...	...	...	...
Ruby Plains ...	...	...	...	...
Denison Downs...	...	...	...	...
West Kimberley:				
Obagama ...	258	9	...	...
Derby	91	7	217	...
Yeeda	...	...	...	...
Liveringa ...	...	...	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs...	99	6	...	...
Fitzroy Crossing	52	6	25	2
Fitzroy (C. Blythe)	...	...	...	...
Quanbun ...	35	2	...	...
Nookanbah ...	...	...	...	...
Broome	Nil	...	179	...
Roebuck Downs	...	...	...	...
Thangoo	...	...	...	...
La Grange Bay...	12	3	2	1
North-West:				
Wallal ...	11	1	6	1
Condon	Nil	...	5	1
De Grey River ...	Nil	...	...	...
Port Hedland ...	7	1	21	1
Boodarie ...	Nil	...	...	...
Yule River ...	...	...	...	...
Warralong ...	22	3	...	...
Muccan	30	3	...	...
Ettrick	...	...	...	...
Mulgie	52	2	...	...
Eel Creek ...	...	...	...	...
Coongon	87	4	...	...
North-West—*cont.*				
Warrawagine ...	...	...	...	...
Braeside... ...	...	...	...	...
Bamboo Creek ...	240	4	28	1
Marble Bar ...	163	4	139	4
Warrawoona ...	63	5	118	5
Corunna Downs...	47	4	...	...
Nullagine ...	107	4	119	5
Yandicoogina ...	...	...	...	...
Tambourah ...	...	...	...	...
Kerdiadary ...	...	...	...	...
Roy Hill... ...	147	5	...	...
Mosquito Creek	...	...	...	...
Mulga Downs ...	33	3	...	...
Woodstock ...	76	3	...	...
Mt. Florence ...	...	...	...	...
Tambrey ...	17	4	...	...
Millstream ...	76	3	...	...
Yandyarra ...	20	1	...	...
Mallina	...	...	...	...
Whim Creek ...	Nil	...	Nil	...
Cooyapooya ...	Nil	...	...	...
Woodbroke ...	...	...	...	...
Croydon... ...	69	3	...	...
Balla Balla ...	5	1	Nil	...
Roebourne ...	2	2	Nil	...
Cossack	3	1	Nil	...
Fortescue ...	Nil	...	Nil	...
Mardie	Nil	...	...	...
Mt. Stewart ...	...	...	...	...
Yarraloola ...	Nil	...	...	...
Chinginarra ...	Nil	...	...	...
Onslow... ...	Nil	...	9	...
Peedamullah ...	Nil	...	...	...
Red Hill	27	2	...	...
Mt. Mortimer ...	...	...	...	...
Wogoola ...	...	...	...	...
Nanutarra ...	...	...	...	...
Yanrey	...	...	...	...
Point Cloates ...	Nil	...	...	...
Gascoyne:				
Winning Pool ...	Nil	...	Nil	...
Towara	1	1	...	...
Ullawarra ...	...	...	...	...
Maroonah ...	53	2	...	...
Thomas Police Station	...	...	...	...

RAINFALL—*continued.*

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
Gascoyne—*contd.*				
Bangemall ...	17	1	...	...
Mt. Augustus ...	...	...	...	...
Minnie Creek ...	20	1	...	...
Yanyeareddy ...	Nil	...	...	...
Williambury ...	...	...	...	...
Wandagee ...	...	...	...	...
Bernier Island ...	Nil	...	..	...
Boolathana ...	...	...	...	...
Carnarvon ...	Nil	...	Nil	...
Cooralya... ...	...	...	...	...
Doorawarrah ...	...	...	...	...
Mungarra ...	10	2	...	...
Clifton Downs ...	...	...	...	...
Dairy Creek ...	...	...	...	...
Mt. Clere ...	...	...	...	...
Errivilla... ...	...	...	...	...
Dirk Hartog Island	Nil	...	...	...
Sharks Bay ...	Nil	...	4	...
Kararang ...	Nil	...	...	...
Meedo	...	...	...	...
Tamala	Nil	...	...	...
Wooramel ...	Nil	...	4	1
Hamelin Pool ...	Nil	...	4	1
Byro	11	3	Nil	...
Yarra Yarra ...	20	1	...	...
Berringarra ...	Nil	...	Nil	...
Mt. Gould ...	7	1	...	...
Moorarie... ...	...	...	...	...
Peak Hill ...	23	2	17	1
Horseshoe ...	9	1	13	4
Abbotts	33	4	5	2
Belele	...	...	...	...
Mileura	108	1	Nil	...
Milly Milly ...	...	...	...	...
Manfred	8	1	Nil	...
Meelya	...	...	...	...
Woogorong ...	...	...	...	...
Boolardy... ...	...	...	...	...
Billabalong ...	Nil	...	...	...
Wooleane ...	Nil	...	Nil	...
Murgoo	Nil	...	Nil	...
Meeka	17	1	Nil	...
Mt. Wittenoom ...	53	1	Nil	...
Nannine	50	1	Nil	...
Star of the East...	30	1	Nil	...
Annean	34	1	8	1
Tuckanarra ...	25	1	Nil	...

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
Gascoyne—*contd.*				
Coodardy ...	...	...	...	...
Cue	23	2	9	1
Day Dawn ...	15	1	Nil	...
Lake Austin ...	33	1	Nil	...
Lennonville ...	14	1	5	1
Mt. Magnet ...	14	1	Nil	...
Warracoothara...	...	...	...	...
Challa	21	1	Nil	...
Youeragabbie ...	...	...	...	...
Murrum	15	1	...	...
Yalgoo	9	2	3	2
Gabyon	...	...	...	...
Gullewa	...	...	...	...
South-West Division (Northern Part):				
Murchison House	12	1	...	...
Mt. View ...	Nil	...	...	...
Yuin	...	...	...	...
Northampton ...	21	1	13	1
Mt. Erin ...	...	...	...	...
Oakabella ...	...	...	...	...
Narra Tarra ...	...	...	...	...
Tibradden ...	19	1	...	...
Sand Springs ...	Nil	...	Nil	..
Mullewa... ...	3	1	5	1
Kockatea ...	1	1	12	2
Bootenal ...	...	...	...	...
Geraldton ...	4	1	Nil	...
Greenough ...	...	...	4	1
Dongara ...	6	1	Nil	...
Dongara (Pearse)	8	1	13	1
Strawberry ...	Nil	...	...	...
Mingenew ...	7	2	20	2
Rothesay ...	2	1	16	1
Field's Find ...	14	1	...	...
Carnamah ...	Nil	...	5	1
Watheroo ...	35	4	20	1
Dandaragan ...	35	2	48	3
Moora	36	2	11	2
Yatheroo ...	40	3	38	4
Walebing ...	35	3	41	5
New Norcia ...	76	4	25	2

RAINFALL—*continued.*

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
SOUTH-WESTERN DIVISION, CENTRAL (COASTAL):				
Gingin	83	3	66	5
Belvoir	12	1	33	2
Mundaring ...	105	4	...	...
Guildford ...	46	4	45	6
Kalbyamba ...	70	7	...	...
Canning W't'r'w'ks	50	4	68	5
Perth Gardens ...	44	5	58	7
Perth Observatory	49	7	52	7
Subiaco	34	2	35	6
Claremont ...	52	3	61	7
Claremont (Richardson):	37	3	...	...
Fremantle ...	41	5	51	6
Rottnest	59	5	29	...
Armadale ...	6	2	...	...
Rockingham ...	50	3	76	6
Canning River ...	135	6	61	4
Jarrahdale ...	137	4	164	5
Mandurah ...	104	6	92	5
Pinjarra	102	5	54	4
Harvey	...	...	142	8
SOUTH-WEST, CENTRAL PART (INLAND):				
Goomalling ...	...	...	...	...
Momberkine ...	10	2	13	2
Culham	23	3	28	3
Newcastle ...	16	2	20	2
Eumalga ...	94	4	...	...
Northam ...	17	3	5	1
Grass Valley ...	8	1	...	...
Meckering ...	12	1	...	...
Cunderdin ...	Nil	...	...	...
Doongin	5	1	13	2
Whitehaven ...	...	...	...	...
Sunset Hills ...	51	3	34	4
Cobham	19	5	28	5
York	9	1	30	...
Beverley ...	32	1	6	2
Barrington ...	20	3	...	...
Sunning Hill ...	47	3	15	3
Wandering ...	44	4	17	5
Pingelly ...	21	1	Nil	...
Marradong ...	83	4	34	3

Stations.	November. No. of points 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
SOUTH-WEST—*contd.*				
Bannister ...	66	5	27	4
Narrogin ...	51	3	42	6
Wickepin ...	...	...	28	4
SOUTH-WEST DIVISION (SOUTHERN PART):				
Bunbury ...	168	5	88	5
Collie	135	7	105	7
Salvation Army Settlement	...	...	...	...
Glen Mervyn ...	187	7	192	7
Dardanup ...	185	7	93	6
Donnybrook ...	157	6	137	9
Boyanup ...	173	9	68	7
Busselton ...	213	9	74	8
Quindalup ...	...	...	...	...
Margaret River	125	9	...	...
Lower Blackwood	220	8	...	...
Karridale ...	196	10	302	12
Augusta ...	76	5	488	11
Cape Leeuwin ...	139	16	375	12
Biddellia ...	115	9	...	...
The Warren ...	156	6	...	...
Lake Muir ...	98	9	145	8
Mordalup ...	66	10	143	10
Deeside	72	8	119	9
Riverside ...	77	6	...	...
Balbarup ...	104	6	167	11
Wilgarup ...	114	8	129	9
Mandalup ...	191	5	183	4
Bridgetown ...	132	7	114	11
Greenbushes ...	285	9	251	9
Williams ...	50	6	35	6
Arthur	38	6	34	6
Darkan	...	...	...	...
Wagin	18	2	74	6
Glencove ...	34	6	50	6
Dyliabing ...	28	1	40	2
Katanning ...	45	7	61	...
Kojonup ...	30	2	68	4
Broomehill ...	31	3	64	6
Sunnyside ...	45	5	56	6
Woodyarrup ...	60	6	83	7
Cranbrook ...	38	2	105	4
Blackwattle ...	39	4	164	3
Mt. Barker ...	38	7	238	6
Kendenup ...	36	4	147	5

RAINFALL—*continued.*

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
South-West—*contd.*				
St. Werburgh's	60	9	...	...
Forest Hill ...	64	7	296	9
Denmark ...	125	7	273	7
Albany	47	8	459	11
Point King ...	45	5	...	...
Breaksea ...	43	7	319	10
Wattle Hill ...	...	..	...	...
Cape Riche ...	30	2	...	...
Pallinup ...	35	4	84	6
Bremer Bay ...	34	5	81	10
Jarramongup ...	...	...	...	...
Eastern Division:				
Lake Way ...	...	...	9	3
Mt. Sir Samuel ...	16	1	14	2
Lawlers	89	3	9	2
Leinster G.M. ...	...	...	...	...
Lake Darlôt ...	...	...	...	...
Diorite King ...	27	2	...	...
Sturt Meadows...	...	...	...	...
Mt. Leonora ...	10	2	8	2
Mt. Malcolm ...	5	2	1	1
Mt. Morgan ...	10	1	32	3
Burtville ...	...	...	78	1
Laverton ...	4	1	54	3
Murrin Murrin...	1	1	15	5
The Granites ..	8	1	34	3
Tampa	10	1	...	...
Niagara	...	...	...	...
Yerilla	4	1	...	...
Edjudina ...	...	...	...	...
Menzies	3	1	13	1
Mulline	...	...	...	...
Wangine ...	...	...	...	...
Waverley ...	30	1	38	2
Goongarrie ...	12	1	20	2
Mulwarrie ...	33	1	36	1
Kurawa	15	1	12	2
Dixie Gold Mine	19	2	...	...
Kurnalpi ...	10	2	3	2
Bulong	9	1	7	2
Kanowna ...	14	1	5	1
Kalgoorlie ...	15	2	22	3
Coolgardie ...	33	2	22	2
Burbanks P.O. ...	21	2	19	2

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
Eastern—*contd.*				
Burbanks Birthday Gift	23	1	19	2
Woolubar ...	...	...	Nil	...
Widgiemooltha...	22	2	36	2
50-Mile Tank ...	2	1	18	2
Norseman ...	20	3	17	2
Bulla Bulling ...	26	...	17	...
Woolgangie ...	25	1	...	...
Boorabbin ...	13	2	16	1
Karalee	20	1	*Nil*	...
Yellowdine ...	38	1	...	...
Southern Cross...	12	1	3	1
Mt. Jackson ...	25	1	...	...
Bodallin ...	Nil	...	23	4
Burracoppin ...	...	...	...	...
Kellerberrin ...	20	1	14	2
Mangowine ...	...	...	...	...
Wattoning ...	...	..	...	...
Eucla Division:				
Ravensthorpe ...	11	3	104	9
Coconarup ...	15	2	...	...
Hopetoun ...	6	2	141	8
Fanny's Cove ...	20	4	...	...
Park Farm ...	6	2	...	...
Esperance ...	1	1	48	...
Gibson's Soak ...	Nil	...	...	...
30-Mile Condenser	Nil	...	...	...
Swan Lagoon ...	26	6	...	...
Grass Patch ...	36	5	61	10
Myrup	10	3	...	...
Lynburn ...	...	...	...	...
Boyatup... ...	11	2	...	...
Middle Island ...	...	...	...	...
Point Malcolm ...	36	5	...	...
Israelite Bay ...	27	3	48	3
Bulbinia ...	...	...	...	...
Frazer Range ...	30	1	...	...
Balladonia ...	37	3	25	...
Southern Hill ...	...	...	...	...
Eyre	47	...	8	4
Clifton Downs ...	42	2	...	...
Madura	...	...	...	...
Mundrabillia ...	47	3	...	...
Eucla	64	3	85	4

The Observatory, Perth,
8th January, 1902.

W. E. COOKE,
Government Astronomer.

Return of Fruit imported into Western Australia during December, 1901.

Name of Port.	No. of Ships.	No. of Consignments Inspected.	Total No. of Cases.	No. of Cases Passed.	No. of Cases Prohibited.	No. of Cases Destroyed.	No. of Cases of														
							Apples.	Apricots.	Bananas.	Cherries.	Gooseberries.	Lemons.	Peaches.	Oranges.	Passion Fruit.	Pears.	Plums.	Rhubarb.	Pomoloes.	Pines.	All other fruits.
Fremantle ...	18	93	9754	9006	748	748	3	55	1100	2537	309	1843	...	1666	...	...	1355	...	...	...	138
Albany	6	11	379	379	...	...	...	59	20	115	17	8	5	5	...	...	129	3	...	...	18
Geraldton ...	2	2	24	24	...	...	...	...	8	...	...	...	...	4	...	...	...	...	12	...	...
Hamelin	...	...	...	...	...	...	...	...	...	...	...	...	...	..	..	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	26	106	10157	9409	748	748	3	114	1128	2652	326	1851	5	1675	...	...	1484	3	12	...	156

Department of Agriculture,

2nd January, 1902.

Return of Fruit Trees and Plants imported into Western Australia during December, 1901.

Name of Port.	No. of Ships.	No. of Consignments of Trees or Plants.	Total No. of Trees or Plants in such Consignments.	No. of Consignments passed.	Total No. of Trees or Plants in such Consignments.	No. of Consignments of Trees or Plants prohibited.	Total No. of Trees or Plants in such Consignments.	No. of Packages dipped.	No. of Trees.															
									Ornamental and Pot Plants.	Almonds.	Apples.	Apricots.	Cherries.	Figs.	Lemons.	Limes.	Mulberries.	Oranges.	Peaches.	Pears.	Plums.	Small Fruits.	Vine Cuttings.	All other Trees.
Fremantle ...	8	10	327	8	327	...	...	10	327	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Albany ...	1	1	100	1	100	...	...	4	100	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Geraldton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	9	11	427	9	427	...	...	14	427	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Department of Agriculture.
2nd January, 1902.

By Authority: Wm. Alfred Watson, Government Printer, Perth.

JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA.

Vol. 5.—Part 2.

FEBRUARY, 1902.

PERTH:

BY AUTHORITY: WM. ALFRED WATSON, GOVERNMENT PRINTER

1902

NOTES.

CALVING DATES.—A record should always be kept; especially is this necessary where winter dairying is practised with well bred cattle, good cows will milk right up to date of calving, many of them never betray themselves by a falling off in milk as they approach their time, and if not dried off it is very detrimental to their future usefulness. Art has bred in a useful function that of converting everything consumed into milk, but the beast should not be abused, the function should be regulated, else nature will revolt somewhere and loss ensue either in the milker or her offspring.—*Agricultural Gazette.*

LARGE OUTPUT OF OLIVES.—The largest olive grove in the world is at San Fernando, U.S. America, and its output this year beats all records. There are 1,400 acres in the grove, with nearly 30 miles of drives. One hundred and fifty Chinese are at work gathering the crop. The grove this year will produce 3,000 barrels of pickled olives and 1,000 barrels of pure oil. This is as many olives as the whole State has ever produced in any preceding year. Other orchards in Southern California are bearing as well in proportion, and the largely increased product is expected to materially reduce the price of California pickled olives and olive oil.—*Weekly Chronicle.*

WOOLLY APHIS.—The woolly aphis, says the American *Weekly Chronicle*, is a sort of cousin to the phylloxera, and is about as difficult to eradicate. So far as it is found on the branches, it can be disposed of with little trouble by the use of kerosene emulsion or other caustic applications, but on the roots it cannot be got at. Boiling water, wood ashes or other caustics which will not injure the tree can be applied to the crown and the large roots which can be uncovered, and in this way, and by keeping the branches clean, the pest can be kept down, but it cannot be eradicated. It seems to be much more injurious in some countries and districts than in others, and the best way to deal with it is by the use of resistant stocks, of which Northern Spy is thought to be the best. It requires some skill to secure Northern Spy roots, as cuttings must be rooted for the purpose, except as trees may be known to be growing on their own roots, in which case ordinary root grafting may be used.

RESTORING FLOW OF MILK.—A leading writer in a leading English journal says " Once the full flow has ceased, no efforts, and no amount of feeding will restore it, and hence the importance of supplementing the failing grass as soon as necessary with other suitable food." This is a truism that should never be forgotten in

cow management; yet it has a but—which is that milk breeds of cattle will respond to better feed, if by carelessness or necessity they are underfed for a time and fall off. Beef breeds will not do so, for with the least neglect they fall off, and on re-enrichment of pasture or feed they will put it on their backs, not into the butter box. A well bred dairy cow will fall off to a mere trifle of product. Say 2lbs. of butter per week after 8 or 9 months milking and readily return to 10lbs. if not nearer to calving than 3 or 4 months. This is just one of the great advantages of well bred cows.

THE *English Farmer and Stockbreeder* warns British breeders of the competition of Australia in opening markets for pure bred stock in South Africa. It is thought that this outlet for stud stock will be a big thing, and it behoves our pastoralists to take advantage of it.

DIPPING STOCK.—Mr. R. O'Bryen, stock inspector for Kennedy North, Queensland, reports some interesting facts in proof of the value of dipping cattle for ticks. Mr. O'Bryen was present at a station in the Ingham district (Stoneleigh), where some horses and cattle were put through the dip. At that station the stock are regularly dipped, the results being most satisfactory. The cattle and horses are quite free from ticks, and their coats look like sealskin. The contrast between those that had been periodically dipped and stock that had not been so treated was very great. The inspector states that he saw 30 dairy cattle from the Antigua Estate dairy that had been twice dipped, and since the first dipping the milk had increased from 3 pints to 2 quarts each cow per day.—*The Pastoralist's Review.*

WHEN TO CUT LUCERNE.—Mr. H. M. Cottrell, of the Kansas Experiment Station, reports officially upon this matter:—

Alfalfa should be cut when not more than one-tenth of the plants have come in bloom. Cut at this early stage, the yield of hay for the season will be much greater than if the alfalfa is cut near maturity, and every pound of hay secured will be worth more for feed. At the Kansas Experiment Station, a strip through a field of alfalfa was cut when one-tenth was in bloom, another strip was cut after full bloom had passed. The strip cut early was nearly ready to cut the second time when that cut after full bloom was being harvested the first time. The strip cut early grew vigorously through the season, and made three cuttings and a good aftermath. The strip cut after full bloom gave a low yield the first cutting, and did not grow sufficiently to yield a good second cutting. Early cuttings seem to invigorate the plant. The late cutting of the first crop seems to injure the plant more than at any other time, and we have found it profitable to cut alfalfa the first time as soon as one-tenth was in bloom, even though the weather was bad, and we knew that the crop would spoil in curing. The increased yield from

succeeding cuttings, over that cut late, much more than makes up for the loss of the first crop. Successful clover-growers, the first time they try alfalfa, often ruin the stand, so that it has to be ploughed up, by waiting to cut until it reaches the stage at which clover is usually cut. The great value of alfalfa is the large per cent. of protein it contains, that material in feed that is absolutely necessary for the formation of blood, lean meat, and milk. The higher the protein in alfalfa the more valuable the crop. Experiments made in three States—Kansas, Colorado, and Utah—prove that alfalfa cut in the first bloom will give the greatest yield and feeding value. The leaves of alfalfa contain more than three times as much protein as the stems, a ton of alfalfa leaves containing as much protein as 2,800lbs. of bran. Every care should be taken in curing alfalfa to save the leaves.

MOTTLED BUTTER.—At our institutes the question as to the cause of mottled milk has often been up. The Maryland Experiment Station has issued a bulletin on the subject, with the following conclusions:—

1. The uneven distribution of salt is the cause of unevenly coloured butter, spoken of as mottled butter.
2. Washing the butter with water below 40 degrees does not cause mottles. It does, however, make a little more working necessary to thoroughly distribute the salt.
3. The light coloured streaks or portions of mottled butter are not caused by an excess of casein, but mottles are evidently caused by some physical action of salt on the butter fat which causes it to admit more light.
4. Mottles can be prevented by working the butter sufficiently to thoroughly distribute the salt.
5. Butter washed with water at 40 degrees and under, and worked immediately, shows a better grain when sufficiently worked to insure its being evenly coloured than with any other treatment.
6. Washing butter with water at 40 degrees does not injure its firmness when subject to high temperature.—*Farm, Field, and Fireside.*

MOISTURE IN BUTTER.—The question of the proportion of moisture in butter has been investigated in England by a departmental committee, which has recommended, according to the cable news, that a limit of 16 per cent. should be fixed by law. As the recommendation will doubtless become law, a stop will be put to the business of selling a mixture of butter and milk as butter by Messrs. Pearks, Gunston, and Tee, Limited, as the notices issued by them state that the percentage of water in the butter is increased by the process to about 24 per cent. The establishment of a limit of 16 per cent. will not affect Australian butter, which generally contains a smaller proportion of moisture.

THE INSECTIVOROUS BIRDS OF WESTERN AUSTRALIA.

By Robert Hall.

TRUE NIGHT-FLYING INSECT-EATING BIRDS.

In bringing together a number of birds as the present, one does so with a slight diffidence. There are the same birds that fly by night as well as by day, while there is a certain soft-plumaged section of birds that practically does in the twilight and dark what most birds do in the day. It is generally known that owls are nocturnal, and, being vermin destroyers on a large scale, they will receive particular notice later. However, there is an order that embraces the Frogmouths and Nightjars, and in these alone is sufficient for our consideration. The Horsfield's Bush-Lark, Reed-Warbler, Curlew, Black Fantails, Cuckoos, and certain water-fowl stream across the sky line at very irregular hours of the night, while the first two sing most delightfully throughout the dark; being the only Australian birds that do so, according to our present knowledge. Frogmouth is a name recently applied to the birds known as Podargi; and judging by the peculiarly broad, short, and comical expression, it is well done. Another name, the one commonly understood, is Morepork. This, we must remember, is not the bird of the "morepork or boo-book" call, and only in recent years have we observed a case of mistaken identity. There are four Australian species of Nightjars in our State, as well as two of the four known species of Frogmouths.

Large-tailed Nightjar.

Caprimulgus macrurus, Hors. (Kap-ri-mul'gus mak-ro'rus).

Capra, a goat; *mulgeo*, to milk; *makros*, long; *oura*, tail.

Caprimulgus macrurus, Gould, "Birds of Australia," fol., vol. ii., pl. 9; "Key to the Birds of Australia," Hall, p. 54 (1899).

Geographical Distribution.—Areas 9, 7, 6, 4, 3, 2, 1.

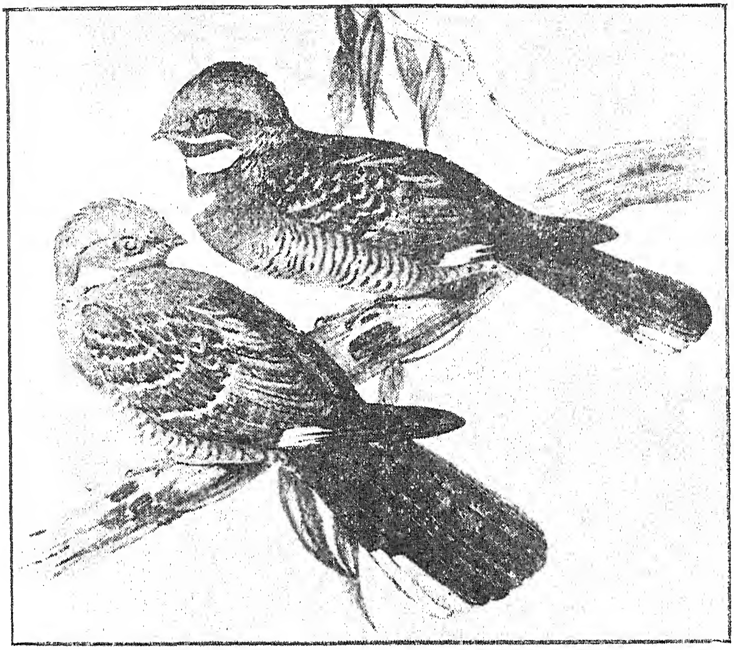
Key to the Species.—Freckled brown, large white marks near throat; four outer primaries with white spots; rictus armed with strong bristles; mouth split, very wide. Total length, 11·5 inches; wing, 7·5 inches; tail, 6in.

The Nightjars are similar to the birds known at the present day in other countries as "Whip-poor-Will," Nighthawks, etc. One rarely sees the bird other than by disturbing it upon the ground of the open parts of a forest, and you may travel for years without so doing. Around a camp fire a dozen may be noticed during an evening, though the bird is seldom seen to congregate

even to this limited extent. Its food consists of insects, some of which are large and of a very destructive nature.

Nest.—The bare ground, within lightly-timbered country.

Eggs.—Two to a sitting. Creamy, with slatey grey spots evenly dispersed on the surface. Length, 1·15 inch; breadth, 0·85 inch.



SPOTTED NIGHTJAR.

Eurostopus argus, Hartert. *(U-ros'to-pus ar'gus).*

Eurus, wide; *pous (podos)*, foot; *argus*, hundred eyes (bright).

Eurostopus argus. A preserved and mounted specimen in the Victoria Museum. "Key to the Birds of Australia," Hall, p. 55 (1899).

GEOGRAPHICAL DISTRIBUTION.—Australia, but not Tasmania.

KEY TO THE SPECIES.—Freckled grey and brown; large white patch at side of neck; abdomen and under tail coverts uniform rusty brown; mouth is deeply cleft, and gape is very wide; rictus without any conspicuous bristles; wing less than 9 inches, tail 6·5 inches.

A second species of this genus is *E. albigularis*, V. and H., and to date we only know it as the bird found in the central area. There is very little to choose between them in the matter of appearance,

unless it is that the species under review has its undertail coverts and abdomen a uniform rusty brown, and the wing between $9\frac{1}{2}$ and $10\frac{1}{2}$ inches in length. It is remarkable that the plumages are said to vary with the nature of the soils the birds frequent.

In appearance, for the sake of common description, they might be called miniature "Moreporks." While hawking for insects in the twilight, the movements of this species are particularly rapid. During the day it is found upon the ground, or close to it, reposing in slumber. Like nearly all the night-flying birds, the Spotted Nightjar is beneficial to man, coming upon the scene just as the feeding time of other birds is drawing to a close. Grasshoppers, beetles, and soft-bodied insects are generally found in the stomachs of dissected birds.

Nest.—Simply the ground, and in close relation to a stone, etc., to serve as a partial breakwind.

Egg.—One only for a sitting; of a uniform light olive-stone colour, with here and there a roundish purple blotch or spot (A. J. Campbell). Length, 1 inch $5\frac{1}{2}$ lines; breadth, 1 inch $1\frac{1}{2}$ lines.

Owlet Nightjar.

(Little Morepork).

Ægotheles novæ-hollandiæ, Lath. *(Ego-thel-ès no-vè-hol'an-di-ë.)*

Aigos, a goat; *thele*, teat; *novæ-hollandiæ*, of New Holland.

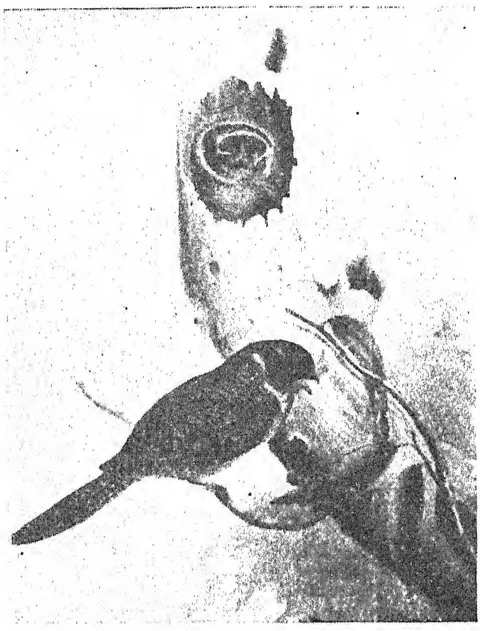
Ægotheles novæ-hollandiæ, Gould, "Birds of Australia," fol., vol. ii., pl. 1; "Key to the Birds of Australia," Hall, p. 55 (1899).

Geographical Distribution.—The whole of Australia and Tasmania.

Key to the Species.—Mouth very much split; gape very wide; two stripes on brown head and two crescents on hinder part white; back, rump, upper wing coverts, and upper tail coverts deeply vermiculated with pale grey; tail, barred; wing quils, grey, marbled, and spotted; lower parts whitish, with dusky vermiculations. Total length 8·5 inches. Some specimens show a rufous tinge on parts of the body.

The "Owlet" belongs to the weak-footed order of birds, and although nocturnal it is quite opposed to the Owls, which are a portion of the strong-footed order. While these latter depend very much on their talons for the critical capture of their prey, the little insectivorous bird trusts to its open mouth, which, when expanded, is a formidable trap to an insect wending its homeward way. Such a mouth is rapidly moved forward by almost noiseless wings. Mr. Gould writes of this species:—"During the day it resorts to the hollow branches or spouts, as they are called, and the boles of the gum-trees, sallying forth as night approaches in quest of insects, particularly small coleoptera. Its flight is straight, and not characterised by the sudden turns and descents of the *Caprimulgi*" (Frogmouths, etc.). "On driving it from its haunts I have sometimes observed it fly direct to a similar hole in another tree, but

more frequently parallel to it. When assailed in its retreat it emits a loud hissing noise, and has the same stooping motion of the head observable in the Owls; it also resembles that tribe of birds in its erect carriage, the manner in which it sets out the feathers round the ears and neck, and in the power it possesses of turning the head in every direction, even over the back, a habit it is constantly practising. A pair I had for some time in captivity frequently leapt towards the top of the cage, and had a singular mode of running or shuffling backwards to one corner of it."



Owlet Nightjar.

When traversing the woods, the usual mode of ascertaining its presence is by tapping with a stone or a tomahawk at the base of the hollow tree, when the little inmate will almost invariably ascend to the outlet and peep over to ascertain the cause of the disturbance. If the tree be lofty, or its hole appears inaccessible to those beneath, it will very likely retire to its hiding place, and there remain till the annoyance be repeated. It then flies off to a place of greater security.

Nest.—Simply the dust in a hollow tree, a few inches down.

Eggs.—Three or four to a sitting; white. Length, 1 inch; breadth, 0·85 inch.

Tawny Frogmouth.

(*Morepork*).

Podargus strigoides, Lath. (*Po-dar'gus strig-oid-es*).

Pous (*podos*), foot; *argus*, hundred eyes; *strix*, a screech owl; *eidos*, like.

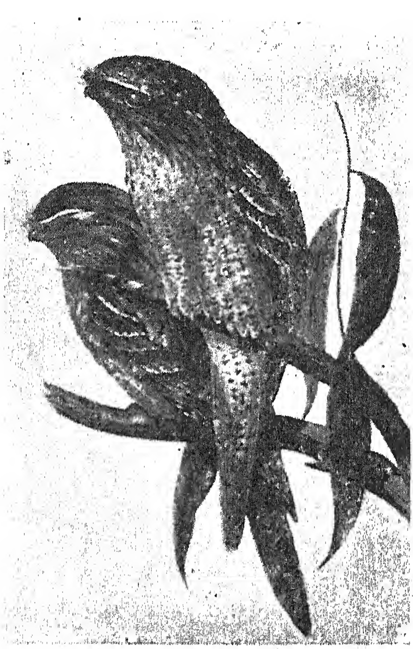
Podargus humeralis, Gould, "Birds of Australia," fol., vol. ii., pl. 3; "Key to the Birds of Australia," Hall, p. 55 (1899).

Geographical Distribution—Australia and Tasmania.

Key to the Species.—General plumage, tawny, streaked and blotched, the male being smaller and much more lightly marked than the female; gape very wide; mouth very much split; nostrils, a narrow split near the base of the bill, protected by a membrane and hidden by plumes of feathers; tarsus shorter than middle toe, retrices pointed; tail distinctly less than 10 inches; wing more than 9 inches.

Being nocturnal the Frogmouth has a delicate plumage, assuring for it, as it does for an owl, noiseless flight. As a particularly useful bird it plays its part in the dark of the day, devouring the grubs that come from the ground in the night and which retire before sunrise. The common chafer larvæ, which do an immense amount of harm among the grass roots, have this species as an enemy. In popular opinion it holds what is due to the Boobook Owl, in the power of saying "more-pork" or "boo-book," according to your translation of it, but it has been proved beyond a doubt that the Owl, and not the Frogmouth, says "more-pork." One of my friends on the Victoria River caught one, and releasing it in the evening, it flew to a tree, and immediately offered up thanks by saying "more-pork" twice. Its call is a feeble and unattractive one, except to its own kin. "Oom, oom, oom," repeated about a dozen times, is a simple description. Amongst the various notes I hold on this species I would like to quote those in a letter to me from one of my correspondents, Mr. J. A. Hill, who says: "On account of the nocturnal habits, little is known about it. Certainly it is a most inoffensive bird, and as far as my observation goes, it lives chiefly on insects and mice. In the daytime it roosts generally on a thick bough, with another piece of dry limb over it. The dry limb being of the same colour as the bird, it would be easily passed without being noticed. This at least helps to show that the bird not only knows its own colour, but also the protection afforded by the dry piece of wood above, as hawks, magpies, etc., would not dive at it while against the limb. They generally roost in pairs, and in the same place for weeks together. It does not fly until forced by the throwing of a stick or in some other way. The breeding season is about the last week in August or beginning of September. The nest is generally composed of a few green leaves placed in a large fork, often not more than 10 feet from the ground, the fork generally being flat but sometimes a little slanting. The nest is so shallow that on more than one occasion I have seen the eggs roll out when the bird was disturbed. The eggs are white in colour and generally two in number, but on one occasion I found three in a nest. It seems to guard its young, for when forced to leave its nest it will sit on a limb near by, snapping its beak very savagely

at you. I have frequently heard the note of this species during the day in the breeding season, but it is generally heard just after sundown." To its menu I can add, from personal observation, centipedes, tarantulas, land crustaceans, and many hard-winged insects. In fact, they are excellent destroyers of garden vermin, often slugs in particular. The plumage of the bird is a clear case of protective colouration, and the mimicry of the bough on which it rests is by the bird well displayed, resting length-wise, as it generally does. On the 19th October, 1894, I found a nest containing two grey-downed young, with male parent sitting at an angle of 45 degrees and motionless. After a few minutes' interval, as if to cast a shadow of doubt on the primates below, its eyelids were opened, and then, but not till then, did it reveal a distinctive marking easy of observation in the broad yellow iris. The female was perched parallel with an almost horizontal bough above us, and



Tawny Frogmouth.

so motionless that it was mistaken for an iguana. Both were studies, and almost unrecognisable. However, a weighty stick carefully deposited destroyed the equilibrium of one, and caused a movement of the wings of the other. On the 25th of November, 1894, a nest was found placed at the junction of three nearly perpendicular limbs. This is an unusual place. The nest was

disturbed, so the birds deserted, to the best of my belief, for that cause. This consideration has been strengthened by my observations recently near Geraldton.

P. phalænoides (Freckled Frogmouth), is a second species. It appears to be rather more common than the preceding species, though not so well distributed. Besides the freckling, and probably the surer means of recognising this species is by the length of tail being less than 10 inches, and wing less than 9 inches (about 8 inches).

Nest.—A flimsy structure of twigs that simply serves the purpose of holding the eggs with care by the bird while flying off and on to it. It is placed on a horizontal fork at varying altitudes in small trees.

Eggs.—Two or three to a sitting; clear white. Length, 2 inches; breadth, 1·4 inches.

BEE-EATERS.

Bee-eaters are numerous and broadly distributed in many parts of the world, but in Australia they stand represented by a single species. This is to be found completely over the continent. For the present, we feel quite justified in placing the bird upon the list for preservation; for the future it is not so easy to judge. Apiaries on a broad scale may offer a tempting bait that birds cannot pass.

The number of insects hoarded in the ground floor of a bee-eater's house is enormous. So large a family is reared by a pair of birds that it is necessary. Whether the nesting birds recognise that hungry little ones go very much unfed on the results of a daily search or not, one is scarcely able to say. Certain it is that they procure and store handsomely a variety of spiders and insects, and, from the larder, draw as home consumption demands it, assisted by the daily forage in the outside world.

Australian Bee-eater.

Merops Ornatus, Lath. (*Me'rops or-nat'us*).

Merops, a bee-eater; *ornatus*, adorned.

Merops Ornatus, Gould, "Birds of Australia," fol., vol. ii., pl. 16; "Key to the Birds of Australia," Hall, p. 56 (1899).

Geographical Distribution—Australia, except Tasmania.

Key to the Species—

Adult Male.—Green mantle; a broad black patch on the foreneck; tail black, the centre feathers, which are elongated, washed or edged with blue; bill long, culmen sharply ridged; feet syndactyl.

Adult Female.—Centre tail feathers much shorter than in male.

Young.—No black on the throat and no blue line below the eye.

The birds associate in small flocks in the thinly-timbered districts, and their elegance and beauty make them general favourites. The exception to the rule is when they approach bee farms, for they do not discriminate between useful and noxious insects.

During the summer months they are universally spread, as far as this continent is concerned, over its Southern parts, from where, in autumn, they go Northward.

Australian Bee Eater.

In its nest building it is very much the same as the Kingfishers, tunnelling holes for nests and laying white round eggs. Such holes have a store of dead insects in readiness for the young. The Spaniards, who eat all sorts of little game with no regard for plumage or habits, capture Bee-eaters at night by going round and pouring water into holes in banks and trees where they roost, at the same time holding a net over the entrances, into which the frightened birds quickly dart. No one but an apiarist, with nests near his bees, would be justified in an act of this kind, and then only for the special purpose of protection.

Nest.—A tunnel in the flat or rising ground, or in the bank of a watercourse. No vegetable matter is placed at the end of it as a rule, the eggs resting upon the ground.

Eggs.—Five to a clutch, pearly white. Length, 0·8in.; breadth, 0·7in.

SCALE ON ORANGES AND LEMONS.

By Geo. Compere.

The question of dealing with insect pests that infest the orchards of this and other countries is one that interests, or should do so, every fruit grower, whether their trees are infested or not, they being liable to become so at any time, therefore it is well that all should keep themselves informed upon this subject, and be prepared to act intelligently in the matter when the occasion arises.

There is, however, a strong impression prevailing amongst some of the growers that the various formulas prescribed by the departments that have been established to deal with and advise in such matters are of little or no use, and it is not uncommon to hear remarks made by some to the effect that this or that person sprayed their trees last season with this or that remedy, and are this season in about the same condition as they were before treatment was made, and will condemn the remedies used; and this is especially so amongst the growers of citrus fruits. There is no denying the truth of such remarks, as it only too often happens that no matter how careful these mixtures may have been prepared and applied, the results are very unsatisfactory. This leads some growers to be ever on the alert for fresh advice and new remedies, and there are some that will try all such as may be recommended to them; and no matter what virtue as insecticides these remedies may possess, and how well applied, the results are always about the same. These unsatisfactory results are not the fault, as some imagine, of the remedies generally recommended for the destruction of orchard pests, or the lack of proper application on the part of those using them, but are the results of natural conditions over which man has no control.

As an illustration of some of these conditions, it may be as well to take for example the black scale (*Lecanium oleae*), this, no doubt, being one of the most common as well as troublesome with which the fruit-growers of this State have to contend against, and which under present methods of combating will cause the expenditure of large sums of money and labour, with nothing in the end to show for it, only that the trees have been kept alive and not damaged to the extent that they otherwise would be had the remedies not been applied, and this in spite of the fact that the very best artificial methods have been employed.

This scale, like all coccidiae, produce great numbers of young, and its increase is something astounding; the adult female being covered with a hard shell, under which her eggs as well as herself is protected, and there is no remedy known up to the present time that will penetrate this shell and destroy the scale and eggs without causing severe damage to the plant also. Soon after the young hatch from the eggs, they make their way out from beneath the

parent scale, and generally crawl to the young tender leaves or shoots of the plant, and locate themselves temporarily on the under side of the leaves or branches, where they pass through the first stages of their life. After leaving their temporary location they will find a suitable part of the tree and locate permanently. During the early stages of their life they can be very readily killed by the application of any of the ordinary washes recommended for the distruction of such pests, such as the kerosene emulsion or resin and soda wash. But in order to accomplish their destruction with these remedies, it becomes necessary to reach them, and this, on citrus trees, will be found almost an impossibility owing to the dense foliage; and with the very best remedies and careful application not more than ninety per cent. of the scale will be touched with the spray, leaving the other ten per cent. to breed and re-stock the plant for the next season, when the same process will have to be repeated over again. Then, too, the scale do not all hatch out at the same time. While the bulk of them hatch in the early spring, it will always be found that while some have hatched out others will have just begun to do so, and so it continues from one end of the season to the other, or, in other words, there is no specific time during the season that all could be killed, even though all could be reached by the spray.

Fumigation with Hydrocyanic gas was expected to overcome the difficulty, and exterminate all the scale upon a tree with a single application, it being argued that the gas would penetrate every part of the tree, and which no doubt it does; but with the gas the same as the spray, it only destroys the scale while in the younger stages of their life, and while there are none that escape on a fumigated tree in this stage the same as with the spray, yet the net results will be about the same, about as many scale this as last season. These same conditions will apply to other scale insects also. It being an endless as well as expensive operation of fighting insect pests with artificial methods.

There are some who may interpret the above as condemning spraying and fumigation altogether, but such is not the intention, as both spraying and fumigation, if properly carried out, will accomplish a great deal in temporarily checking the spread of these pests, and more than that has never been accomplished in any country by the artificial process. And the above has been written for the purpose of pointing out some of the causes that are responsible for the failure to eradicate these pests, as there are some growers who labour under the impression that with one or two applications of any of the various remedies recommended should exterminate the pests from their orchards for all time.

This process, no matter how unsatisfactory it may be, will have to be continued until such time as the more natural one is substituted in its place, by delegating this work to natural enemies, as has been done of late years by California, U.S.A., and the Hawaiian Islands; and these are the only two countries at the present time where any insects that had become serious pests have

been exterminated, or at least to such an extent that they are no longer noticed, and this was accomplished only by the introduction of natural enemies from other countries.

With deciduous trees it is quite different, as it is possible during their dormant season to exterminate the scale pests which may infest them with fumigation or spraying, as the remedies may be applied much stronger, without danger to the plant, than they could be applied to citrus trees.

SEED DISTRIBUTION.

Last season the Department of Agriculture distributed some hundreds of packets of seed to persons in various parts of the State for experimental purposes. The Secretary of the Department is anxious to ascertain the result in order to find the varieties of cereals best suited to the different districts. Those who have planted the seed sent them are invited to send in the results to the Secretary of the Department of Agriculture. Mr. J. Delaney, of Kojonup, who tried some of the seed sent, writes:—"That owing to the very unfavourable season, the wheat yield will not exceed six bushels per acre. The wheat seed received from the Department "Jade" was sown broadcast on good red loam; new land, no manure. The land had been fallowed and ploughed over. Ten pounds of seed was sown on a quarter of an acre in June; it was ripe on 14th December; yield 3 bushels 20 pounds. The "Silver King" was sown at the same time under same conditions; yield at the rate of 12 bushels per acre, ripening one week later, viz., on 21st December. The "Senora," sown at the same time under same conditions, ripening on 30th December, and yielding at the rate of 15 bushels per acre. The "Jade" grew much faster than the others, and in August and September it was several inches higher, when the dry weather came in, and it stopped all at once. The "Jade" and "Silver King" grew to a height of 3 feet 6 inches; the "Senora" growing to 4 feet. The "Jade" wheat is certainly the best for this district, giving twice the yield of some "White Tuscan" that was planted at the same time, and it might have done still better had it been sown earlier." [The results from other growers will be published on receipt of the reports by the Department.—Ed. JOURNAL.]

LOTUS AUSTRALIS AS A POISON-PLANT.

By Alex. Morrison.

In June, 1900, Mr. Samuel H. Edwards, of Ullawarra station, Ashburton River, sent to the Stock Department, in illustration of losses of sheep suffered by him, a specimen of a plant along with the contents of the stomach of a sheep that had evidently been poisoned by it; but the herb was not identifiable from the specimen received. Shortly afterwards, however, Mr. B. H. Woodward, Curator of the Perth Museum, forwarded for identification a specimen received by him from the same district, where the plant was known to the aborigines by the names of "Youra" or "Peepie," and used by them in the capture of fish, being pounded up and thrown into the water, with the result that the fish were stupefied and rose to the surface. This plant was found to be *Lotus Australis*, var. *parviflorus*, and that sent by Mr. Edwards was evidently the same variety, a fact confirmed by pressed specimens subsequently received from him.

According to Mr. Edwards, the herb is named "Wirado" by the natives, who knew it to be poisonous. It is plentiful after heavy rains along the Ashburton and its tributaries, and is found on flats and on the banks of clay-pans, as well as along the banks of the river and creeks. It is only when the shepherds take the sheep to these places that any die.

The plant, after being devoured by sheep, takes effect very quickly, symptoms of poisoning making their appearance within 20 minutes, according to Mr. Woodward's informant. In the winter of 1900, Mr. Edwards lost 50 sheep within three months, poisoned, as he believed, by this herb. He observed that sheep poisoned in the morning died very quickly, and that dry ewes were more rapidly and severely affected than those with lamb—as quickly as in poisoning by strychnine; but while the action of the poison was slower in the case of the latter, which mostly lingered for half a day, he found that a greater number of deaths occurred amongst them; out of 30 sheep poisoned only four being dry.

That the poison is narcotic in its action is evident from the stupefying of fish when thrown into the water, and also from the observations of Mr. Edwards, who remarks that ewes in lamb "stagger about and seem very sleepy, they appear to suffer great pain, swell up a great deal before death, and in the last few minutes swell about the jaws and throat and gasp for breath, while fits also come on."

Mr. Max Koch, of Mount Lyndhurst, South Australia, has placed on record some observations on the poisonous effects of the plant, in the main confirmatory of what is mentioned above. He

says*: "Mr. H. L. Hughes, an experienced man with stock, informs me that this weed (*Lotus Australis*, var. *Behrianus*) is very dangerous to sheep, especially when in fruit. It affects sheep most when they partake of it in quantities on an empty stomach, or when they are kept in a yard after feeding freely of the herb. The symptoms are a drooping of the ears of the sheep, which soon become drowsy and stupid; their stomachs becoming distended, and at last they lie down and die." The action of the herb on fish and also on sheep being narcotic and stupefying, it differs in that respect from the gastrolobium poisons, which bring on a condition of delirious excitement, followed by sudden collapse. It has been suggested of the lotus, as of the gastrolobiums, that it is only injurious in so far as it brings on tympanitis or hoven, which is observed before the death of the sheep; but as may be seen from the evidence given above, the symptoms of poisoning come on within 20 minutes, before tympanitis would have time to develop, and Baron von Müeller many years ago recorded *Lotus Australis* as a deadly and rapid poison, causing sheep to perish in half an hour†. In the case also of ewes in lamb, it was found to be slower in its action than in dry sheep, which would hardly be expected if hoven were the sole cause of the illness, for this complaint, which consists of a suffocative distension of the abdomen, might be expected to take effect more rapidly in a pregnant animal.

The typical *Lotus Australis* has not been recorded as poisonous or injurious, but, on the contrary, is considered by many to be good fodder, as well as a plant suited for ornamental purposes. The variety *parviflorus* or *Behrianus* is the form definitely associated with poisonous properties, and is quite different in aspect from the typical plant, although connected with it by numerous intermediate forms, and therefore considered only a variety, and not a distinct species. In properties, it resembles some species of *Tephrosia*, long known and employed in tropical countries as fish-poisons, and said to be used also by the Australian aborigines for the same purpose. The Baron, in his mention of the poisonous nature of *Lotus Australis*, does not specify any particular variety, but in all probability the variety *parviflorus* was meant.

With regard to the curative treatment of animals poisoned by the *Lotus Australis parviflorus*, there is not much to be said; Edwards remarking that bleeding under the eye seems to have no effect, while, according to Koch, bleeding will often save a sheep. In considering means for the prevention of poisoning, we have seen that, at the Ashburton, sheep were observed to be poisoned only when taken to places where the plant luxuriated, and Koch says, "sheep when grazing in a paddock rarely die from the herb, because they feed on other herbage as well. In the event of a flock being driven over a patch where the herb grows thickly, the best plan is to take them from it, and to let them go. Do not yard them under any circumstances, and should symptoms of

* Trans. Roy. Soc. of S. Australia, XXII, 101, (1898).
† Trans. Roy. Soc. of Vict., VI., 148, 1864.

poisoning appear after yarding, turn the sheep out on feed as quickly as possible." The principle involved in these precautions appears to be to keep the sheep in motion, so as to overcome the tendency to sleep, and increase the chances of elimination of the poison from the system. In gastrolobium poisoning, on the other hand, in which the brain is excited, it is a recognised rule to keep the animals yarded and at rest, so as to avoid fatal collapse from exertion.

MARKET FOR PRODUCE.

A meeting of growers of produce and those interested in trade was held on Thursday, 6th February, at the Governor Broome Hotel, Perth, to consider the advisableness of instituting early morning open market sales, and also the formation of a Growers' Association. Though rather short notice of the meeting had been given, there was a fair attendance. Mr. J. Von Ooran was voted to the chair, and Mr. F. Smalpage appointed secretary *pro. tem.* After the object of the meeting had been fully explained, Mr. W. J. Kiffin Thomas, lessee of the Perth Market, pointed out the need of taking action to bring the producer and the consumer into closer touch. In order to start early morning sales, Mr. Thomas said that the Perth Market was at the service of the growers, who could have their stalls rent free for six months. After discussion, those present formed themselves into a committee, and adjourned the meeting until 8 p.m. on Saturday week, 15th February, when a larger attendance of producers is anticipated. The secretary was instructed to write to the different societies interested, inviting their co-operation, and notifying the preliminary steps taken in the matter. It is anticipated that everything will be in working order in time to submit the final arrangement to the Producers' Conference to be held during the National Show week.

PIQUETTE FOR DISTILLATION.

By A. Despeissis.

Several of our winemakers who own stills for the distillation of the refuse of their fermenting vats have experienced in the extraction of spirits of wine from grape skins such difficulties that I promised them last year to suggest, in the proper season, an easy method for the recovery from the skins of fermentations of the wine residue still left in them.

Two methods have hitherto been practised by those winemakers for the purpose aforesaid, viz.:—1st. Placing the skins soaked with wine in the boiler of the still and distilling the alcoholic vapours direct from that spongy mass. 2nd. Soaking those skins in water and distilling the wash.

Both methods are unsatisfactory. They are either slow, yield impure spirit, or they are wasteful.

The first method mentioned, which consists of charging the copper with the skins and stalks, yields an impure, fiery spirit, highly impregnated with fusel oil, and unless the produce of distillation is passed through again, it is quite unfit for the purpose of fortifying wine.

The second method only extracts one-half of the wine contained in the fermented skins, and is therefore wasteful to a high degree. That method consists in throwing the pressed skins into a vat; pouring water over them; allowing them to steep in that water for a few days, then drawing off the resulting liquid, and either distilling it straight off or storing it in casks for future use. It is easy to understand, when that method is followed, the added water and the wine present in the skins mix together in such a way that they soon constitute a homogeneous liquid. When this is drawn, a portion of that wash still remains in the skins. The addition of fresh water would simply further dilute that residue, and a proportion of the alcohol it is sought to recover would yet be left in the residue. A bulky dilute wash is thus obtained, which is costly to distil, and which, being open to the invasion of such germs as are responsible for acetic and for lactic fermentation, soon become unsuitable for any purpose whatsoever.

The method I last year recommended our still owners to follow was somewhat different. I suggested that the compressed cake left after pressing be broken up and shovelled into a series of empty barrels or vats, with their heads removed, and supplied with a tap at the bottom. That the skins constituting that cake be evenly broken up between the fingers and spread uniformly into each cask, so as to make as uniform and as solid a mass as possible, and that a small quantity of water, say one quart at a time be poured over that mass, and at short and uniform intervals of, say, five minutes, from a can supplied with a rose.

The result of this watering is that the water would gradually work its way downward, and as gradually displace the wine left in

the pressed skins, substituting itself, to a great extent, for that wine which would be driven down before it. At the bottom of the cask the vinous liquid would soon begin to trickle, and would be received into appropriate vessels. After a time the liquid thus streaming out of the vat would become more dilute and such liquid could be collected apart and be used for watering a fresh vat like the first, charged with fermented skins.

This method can be used with advantage by anyone and at any time. An improvement on it I now purpose to explain; it presents even greater advantages.

By this means the manipulation of the skins are reduced, these are more thoroughly exhausted of the wine they contain, and a more uniformly strong piquette results.

The appliances required need not be costly and can be provided at any fermenting shed.

The illustrations used for explaining the method of conducting the operation are taken from L. Rougier in the *Progrès Agricole et Viticole*.

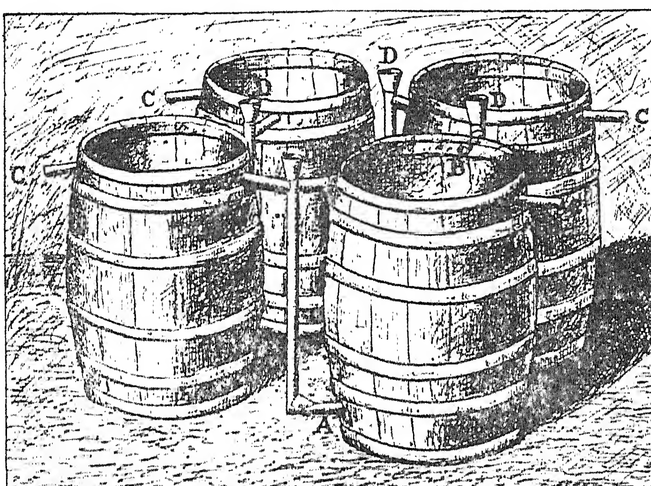


Fig. 1.—Apparatus for extracting piquette from fermented skins.

The apparatus consists of four disused barrels of even size, with their heads taken off, and connected together by means of either tin or indiarubber tubes. These barrels are provided with a perforated false bottom (Fig. 2, X Y) resting on two battens about two inches high. Each barrel is bored with three 1¼ to 1½ inch holes, viz., (Figs. 1, 2, and 3) A at the bottom, B and C at the same level at the top. These holes are so bored that when the barrels are connected for use they stand as shown on Fig. 3 by the letters A, B, and C in each of the four numbered barrels.

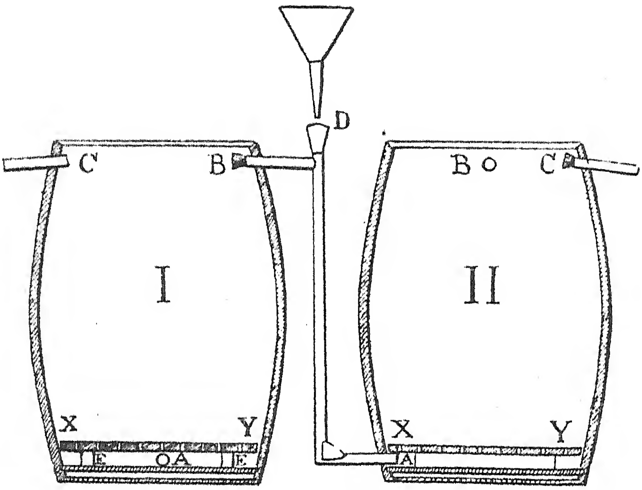


Fig. 2.—Sectional plan of the barrels.

The connection is so arranged that the top end, B. of one barrel leads to the lower end, A, of the next barrel, right round the battery. The tubes of course must be fitted into their respective holes in such a manner that the liquid wont run out. Each vessel is supplied with an outlet tube, C. A few tapering corks to block any one or other tube B or C, and thus direct the flow of the liquid, and small movable sieve caps which are placed over the openings B and C, when running to guard against pips and skins entering the tubes and blocking them, together with a small tin funnel which can fit any of the tubes at D when water runs into them, complete the fittings of the apparatus. The operation of washing the skins is conducted as follows:—

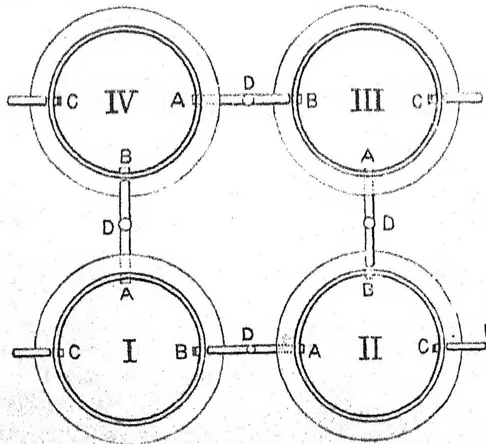


Fig. 3.—Horizontal Section of the Four Barrels.

The tubes having been set, each barrel is filled with a portion of the compressed cake from the press up to the level of the outlets B and C. Whilst filling, the lumps are well broken between the fingers, and the stuff is packed evenly and solidly into the vessels. This done, the overflow C from casks Nos. I., II., and III. are corked, as well also as tube B of No. IV. Water is then slowly run into the funnel down the tube A at D between IV. and I. The water gradually rises from the bottom of No. I., permeating the skins whilst so doing. When it reaches the level of B, water is cut off and is allowed to stand for a quarter of an hour or so. More water is then run down the tube A, already mentioned. This fresh supply lifts up, as it were, the water already in vat No. 1, and transfers it down the tube B A, Fig. 2, into No. II., which, when filled up to the level of its tube B, is likewise allowed to stand for a quarter of an hour or so. The same process is repeated until Nos. III. and IV. are filled with water. After an interval of quarter of an hour, more water still is run down into No. I., and this fresh addition drives an equivalent amount out of No. IV., by the overflow C into some empty cask provided for receiving it. In this manner, a clear piquette almost as strong as the wine itself, is obtained. By this time the skins in No. I. are fairly exhausted of wine. That vat is then emptied and charged again with fresh skins from the press. Overflow C of No. IV. is then corked, and that of the freshly filled No. I., opened. Tube B is, on the other hand, between IV. and I., opened, and the cork is replaced by a sieve cap, whilst tube B is shut off between I. and II. The funnel D is moved to the descending tube between I. and II., and another dose of water run down No. II., whilst an equivalent amount is collected from No. I. By a similar method the exhausted skins in No. II. are replaced by fresh skins from the press. Outlet C of No. II. is corked, and that of No. III. is open, and tube B between III. and IV. is blocked. The same process is continued when No. IV. becomes the last vessel the piquette runs through. In this way, once the battery is in full running order, water is each time poured into the nearly exhausted vat, and the vinous liquid collected from the vat which has been last charged with fresh skins. The vessel with the exhausted skins is then emptied and recharged; the connection is established between this and the preceding one, and stopped between it and the succeeding one.

The piquette thus extracted keeps fairly well, and when distilled at the wine-maker's leisure yields a purer and less injurious spirit than would be the case were the skins distilled straight in the dry state.

FARMERS' POULTRY,

Why they do not Pay.

By Alex. Crawford.

During the past six months I have been visiting a great many of the farmers in most of the agricultural districts of this State, and advocating the keeping of a better class of poultry. In doing so, I am frequently told that a good deal of expense has been gone to in getting well bred birds, and that they have proved an utter failure; that the old common barn door fowls they had previously paid much better, and that no more pure bred fowls were going to be kept. Having been told this so often I looked carefully into the matter, and it did not take long to find out the cause. Ignorance of what the various breeds were most suited for, was at the bottom of it.

Many persons do not know that there is as much difference between the various breeds of poultry as there is between the dairy and beef breeds of cattle. Poultry may be divided into four classes: table, laying, general purpose, and ornamental. As a rule the table varieties are not good layers, neither are the laying breeds good table fowls. The general purpose fowl is usually a fair layer and a fair table fowl, while the ornamental may be a fair table bird and not a good layer, or it may be too small for table use, and the eggs not saleable as in the case of the various kinds of bantams. These birds are generally kept as a hobby and a profit is not expected from them.

The way that the wrong varieties of poultry get into the farmyard is very frequently the result of a visit to an agricultural, or poultry show. In looking around the exhibits, the eye of the farmer, or his wife, is struck with the magnificent size of some of the birds exhibited, such as Dorkings, Indian Game, or Malays. These birds are frequently double, or nearly three times the size of the birds at home, and they think that by getting a rooster of that breed they will improve greatly the breed of fowls they have at home. So they will, from a table point of view; the size of the progeny will be greatly increased, but the laying capacity will be greatly reduced. The common barn-door fowls that they had previously average, perhaps, one hundred and fifty eggs a season, perhaps more. When the pullets from the cross start laying, and a record is kept, they may not average half what the common fowls did, especially if the Indian Game or Malay has been used for crossing. With the Dorking, on suitable soil, there may not be much falling off in the eggs, and the cross may have been fairly successful. The two breeds that have done most to depreciate the keeping of pure bred stock seem to be the two mentioned—Indian Game and Malay—the latter especially. With the exception of the Dorking, these two breeds are the finest table fowls that we have,

and grow to an enormous size; but they are also the worst layers, some Indian Game hens not laying more than twenty-five or thirty eggs in the season, while the Malays may not lay more than fifty. As most farmers count more on the returns obtained from selling eggs than selling the fowls, it is easy to see how their poultry may not pay them when they introduce some pure bred stock. What they have done was to increase greatly the value of their poultry for table purposes and reduced by at least half their value for laying. By doing so, they have lost much and gained practically nothing, for in the present state of our markets here, the greatly superior bird will probably bring very little, if any, more than the common fowls, as fowls for killing in this State are not bought according to their actual value, but at a general average price. So that as a matter of fact the farmer gains nothing, but is considerably out of pocket in improving the table qualities of his selling poultry.

In nearly all districts of the State I have visited, I find the strain of the Malay. The peculiar shape of it can be seen in the birds for many generations, and its poor laying qualities descend with it, and is very hard to overcome. If any one has this cross and wants eggs, there is nothing to be done but to get rid of it. The cheapest way will be to get a cock and a couple or three hens of some other breed, either a purely laying or general purpose one. Keep them shut up by themselves, and set as many of the eggs as are desired, then, when the pullets come into lay, the old hens can be sold off. There is this to be remembered, that very few of the laying breeds will sit, and you will require some of the sitting breeds to rear the chickens unless an incubator is used. Where an incubator is not used, some of the common fowls or generally useful ones should be kept. The principal laying breeds are as follow:—Spanish, Minorcas, Andalusians, Leghorns, and Hamburgs. There are others, but they are rarely to be met with in this country.

At one time, for quantity and quality of eggs, the Spanish stood at the top of the tree, but through forcing the birds up to an ideal but totally useless standard, it has had to give place to the two following. Through in-breeding, from being at one time a very hardy bird, the present day Spanish has become rather delicate, and in very well bred specimens, when the birds get to be a year or more old, the ear-lobe is apt to grow so that it will cover the eye and make the bird blind unless it is cut away. Used for crossing, it is good, and the progeny are generally good layers of large fine white eggs.

From a purely laying point of view, there is not much to choose from so far as the Minorcas and Andalusians are concerned, the latter probably laying the greater number of eggs. To a person who wishes to see uniformity among his fowls, the Andalusian is rather disappointing, for it very often does not breed true to colour, in fact, even from the best birds, the true colour in the offspring is rather the exception than the rule. The Minorca is a deservedly very popular bird, laying large, pure white eggs, and will, under

favourable circumstances, lay nearly 250 eggs a year. It is not a good table fowl, but, on account of its large size, when sent to market will generally bring quite as much as much better birds. It is fairly hardy, a good doer, and when crossed with ordinary fowls improves the laying qualities of the result.

The Leghorns are also good layers, the two most common varieties being the white and the brown. Of these two, probably, the whites are the most profitable, being larger, laying a larger egg, and a greater number of them. Of all the laying breeds, probably, the Hamburgs have the record for laying the greatest number of eggs of any breed. It is to the silver-spangled variety that this pride of place belongs. The eggs are on the small side, about the size of a Brown Leghorn. The Black Hamburgs lay almost as many eggs, which are considerably larger than the silver-spangled. The other varieties are not nearly such good layers. Another good point about Hamburgs is, that if they have a free run they will obtain nearly all their own food, wandering far afield, but never getting lost, and, when disturbed, they will spring up off the ground like a pheasant and fly home.

The disadvantage of keeping them is that they are most inveterate scratchers, and will do almost as much harm in a garden as a pig. It is scarcely conceivable that such small birds could possible do so much mischief in the time. Unless the wings of the Hamburgs are kept cut it is almost impossible to keep them out of a garden even if protected with a six-foot netting fence. They are naturally wild, and much shier than most of the other breeds.

Of the general purpose breeds mention may be made of the Langshan, Wyandotte, Orpington, Plymouth Rock, and Houdan. There are many other breeds that might come under this heading, but these are the most profitable. In leaving out the Brahmahs and Cochins, which are not nearly so profitable as those already mentioned, there is one good point they possess, they are fair winter layers, but there are others better. The Langshans are the largest of breeds mentioned, and have changed considerably from the original type, which was a much shorter legged bird than the present ones. This breed shows its best qualities by laying well in the winter, and it is from it that most of our best winter laying strains have been produced. I can scarcely recommend it as a good breed to be kept pure by farmers, where fowls have such good opportunities of picking up the most of their living for hunting for it. They are sluggish birds, going only short distances from home and much inclined to hang about, waiting for some one to feed them. They eat a large quantity of food, are not very good table fowls, and lay small very brown eggs.

The Wyandottes and Orpingtons have so many good points in common that it is difficult to say which really is the best. I have had more experience with the latter, and am inclined to give the palm to them; but others stoutly maintain that the Golden Wyandotte is superior all round. However that may be, they are

both good, profitable, all-round fowls. They are excellent winter layers, and lay a large number of moderate sized eggs per annum, hardy, and mature quickly, and have this quality, that they are always ready to kill, being blocky from their chickenhood up. They are fairly active, and bustle round for a great part of their food. Of the Wyandottes, there are a number of varieties, golden and silver laced, whites and buffs.

The Orpingtons are divided into single comb and rose comb varieties, and are found in black and buff colours. The buffs get the credit of being the best layers, but there is not much to choose between them. My experience has been that the rose combed are rather better layers than the single combed.

The Plymouth Rock is a well-known fowl all over this State, and when matured is a very fine looking bird; but the chief objections to them are that the young birds are slow to mature, being all legs and wings until five or six months old, and it is quite that age before they are fit for market. The hens, when they get over twelve months old, are very apt to lay on fat internally, and when they do that their laying value is gone. Until twelve months old they lay very well, and if properly fed, and made to take plenty of exercise, lay well until two years. As a rule, it will pay to sell off all the hens at about eighteen months old. They sit fairly well, but are very clumsy with the chickens.

The Houdans, or as they are sometimes called, the French Dorking, on account of having five toes, are the only non-sitters in the general purpose breeds. They do not lay well during the winter months, but make up for it the rest of the year. As table fowls they are difficult to excel, and have less bone in proportion to flesh than any other breed. The only fault that I know of that can be urged against them is that on account of their large crests, when kept in the country where hawks are common, one is apt to lose most of them. The crests prevent them seeing above them, and when a hawk appears they do not see it, and are carried off, while all the other non-crested varieties will take refuge either under their mother or under the nearest bush. They lay a very large pure white egg, and if eggs were sold by weight instead of by numbers, they would probably be one of the most profitable breeds that could be kept. A Houdan crossed in with any of the laying or general purpose breeds, makes an excellent all round fowl, good for table and good for laying.

Of the ornamental breeds it is not necessary to speak much. They include all the bantams, many of which are very beautiful, the Polish silkies, dumpies, and many others; also, the Japanese jungle fowl, with its seven feet long tail. They are ornamental, but not profitable, except where there is a demand for them at fancy prices.

The next reason for fowls not paying is that in many cases, instead of the old fowls being disposed of every year, the young ones are sent to market and the old ones allowed to remain. It is

a pity some of the old fowls on some farms cannot speak, and tell how they had been there for the past eight or ten years, and had not laid an egg for several years. To do the best out of poultry they should be got rid of when they are about two years old, and enough pullets should be reared to take the place of the two-year-old ones each season. When recommending this practice, I am often told that it cannot be done, as no one can remember all the hens and their ages for a couple of years. That is quite true, but it is easy to mark them in such a way that they can be identified at any time. The simplest and cheapest method is to get some copper wire, and cut it into lengths, put it round the right leg of all the fowls that you rear this season, and round the left leg of all the ones reared the following season. When the proper time comes, all that has to be done then is to catch all the fowls with the wire round the right leg and send them away, the following year the ones with the wire on the left will go, and so you can keep on year after year and be certain of only having hens in their prime about the place; and if this is kept up it is astonishing what a difference it will make in the number of eggs per season.

Another cause of fowls not paying is the keeping of too many fowls about a place. Fifteen or twenty fowls may be kept, and these may average, say, 200 eggs per annum. The good wife finds that they are very profitable, and that they bring in a nice amount of pin money, but she is not content, and thinks that if she doubles the number of fowls she will double her income. In actual practice it does not work out so, although the same class of fowls may be kept. The greater the number of fowls kept together the less in proportion are the number of eggs, while the cost of feeding remains the same or even more per head. I do not mean to say that only fifteen or twenty fowls should be kept on a farm, for much depends on the kind of farm it is, and the way the fowls are treated, but what I do say is that a small number of fowls, well looked after, will give a better return than a great number not so well attended to. There is one thing should receive special attention, and that is not to let too many fowls roost in the one fowlhouse; the number should not exceed twenty, less would probably be better.

In-breeding.

It is not unusual for some good fowls to be obtained for a start, and to find that they pay well for a season or two, and then gradually the eggs fall off and the birds decrease in size until at last they do not pay at all. This is generally caused by in-breeding, the young cocks are allowed to run with their mothers and sisters, and the result is the breed rapidly degenerates until after a few years they are not worth the food they eat. Where the cocks are allowed to run about with the hens they should be got rid of every year and fresh ones from an outside strain obtained; by doing so the stamina and size of the fowls can be kept up, and instead of the average size and number of the eggs decreasing, it may be increased.

But at the best this is but a bad way to breed, for when it comes to sitting the eggs they may not be from the best birds; some may even be from the worst of the lot.

A better plan is to get a good cock and two or three hens of the breed you desire to keep, and make a pen to keep them in by themselves all through the breeding season. Save the eggs from this pen and set them, then you will make sure of getting the kind of birds that you want. If a cockerel and pullets are obtained, they will do you for three years without having to purchase any fresh birds. If this is thought to be too expensive—and to get decent well-bred birds of any breed will cost from 10s. to 20s. each—obtain a good cockerel, and pick out a few of the best hens or pullets that you have in your yard; shut them up in the breeding pen and set their eggs, and you will greatly improve the coming fowls. It is not necessary to keep these birds shut up except during the breeding season; the rest of the time they may be allowed to run at large with the outside fowls. Another mistake that is made is the keeping of a lot of cocks about the place. At one farm I visited not long since there were 21 hens and pullets and 15 cocks and cockerels. The best results are obtained from hens when no cocks are allowed to run with them at all; not only are more eggs obtained, but the unfertile eggs will keep much longer. The only cock necessary to be kept on any farm is the one for the breeding pen.

When rearing the chickens, as soon as the cockerels begin to be easily distinguished they should be put into a pen by themselves, well fed and got ready for and sent to market out of the way. Many farmers might do much better out of their killing poultry than they do if they would only take a little trouble. Really good table fowls are scarcely to be had, and by making an arrangement with some of the large hotels to supply superior birds they might get a much increased price.

Such a thing as preparing the killing fowls for sale is rarely thought of here, and so the most of the young fowls that come to market are not much more than skin and bone. If fowls are shut up for ten days or a fortnight, and fed on soft nourishing food, they will often put on a pound or more of flesh in that time, and ought to be worth at least a shilling or eighteen pence more, while the cost would be very little. Pollard and skim milk or crushed maize, or maize meal and milk, will be found very fattening.

Feeding.

Many people buy good fowls of good laying breeds, and are disappointed in the results; and in most cases the fault is not in the fowls but in the feeding. Not long since a lady brought in a fine Leghorn fowl for me to see. She had given big prices for half-a-dozen; they were not laying, although she had them for some months, and she thought there must be something wrong with them. I examined the bird, and it was one of the fattest birds I ever saw or

handled. Although a Leghorn, it weighed $7\frac{1}{2}$ pounds. She told me she fed them four times a day, and as she was afraid of losing them, she kept them shut up in a small yard. I suggested feeding them once a day for a while, and turning them out to get the rest of their living for themselves, and the result was that when they got rid of the surplus fat they commenced to lay and have been doing well since.

The best breeds of laying fowls can easily be spoiled by improper feeding; and so far as I have seen there is a great deal of improper feeding goes on. The usual diet routine is soft food in the morning, generally pollard, and wheat at night. To keep fowls in good condition this is a very fair diet, but by no means the best for egg production. It is too fattening. Half bran and half pollard, or bran and peameal, or pollard and peameal, would be a better morning ration, while oats, peas, barley, or rye would be better for the night one, especially in the summer. Wheat is too fattening to be fed constantly, a little might be given as a change; in fact, a mixture or a variety is better than one continual food. As a rule, fowls do not like oats, but if they get nothing else, and are hungry, they will soon take to them, and lay better than they do on wheat. In winter, more fattening food may be used than in summer—a little maize might be fed two or three times a week, and the wheat ration increased. If it is desired to get eggs in winter, one of the best methods is to feed a little shredded raw meat, or sliced green bone—the latter is especially good for egg production. Fowls are naturally flesh eaters, in the form of insects, worms, etc., but under the artificial conditions in which they are kept they can seldom get the supply they require, so it should be supplied in the form of meat. In the country places opossums or kangaroo can be obtained, as a rule, without much difficulty.

Best Breeds.

I am often asked what are the best and most profitable breeds to keep. It is difficult to answer such a question, for much depends upon circumstances, but if any of the following are kept I do not think there will be much to complain of:—Minorcas, Andalusians, or Leghorns, as layers, and either Orpingtons or Wyandottes as general purpose fowls, and for sitting and also to supply winter eggs.

DEPARTMENT OF AGRICULTURE.

WORK DONE DURING 1901.

In order to give the Minister for Lands an idea of the work performed by the Department of Agriculture, the secretary last week submitted the following outline of its operations during last year:—

CORRESPONDENCE.—During the year, we received and sent out over 20,000 letters, embracing the widest variety of subjects, and addressed to and emanating from all parts of the world. This does not include the enormous amount of clerical work involved in the inter-departmental minutes and correspondence, or in the administration of the various Acts of Parliament referred to later on. About 1,000 files were opened and dealt with, some of the very large ones running into two and three volumes. The department and its experts (who conduct a good deal of their own correspondence on scientific matters in addition to the above) are in communication with about 500 scientific and agricultural bodies and agents throughout the world.

2. PUBLICATIONS.—Of the "Journal" 2,500 copies are printed monthly, of which about 2,000 are wrappered and despatched by this department. The distribution of the "Journal" is a very wide one, the mailing list including agricultural and kindred societies in nearly every country on the face of the globe. In 1895 we published a "Handbook of Horticulture and Viticulture," written by Mr. Despeissis, M.R.A.C., horticultural and viticultural expert of this department. This work has been exhausted for some time now, and in response to continued applications from all parts of the world it has been decided to publish a second edition of 10,000 copies, the matter for which is now in course of preparation. The new edition will be about as large again as the first, and contain over 100 more illustrations. The department has also published six numbers of the "Settlers' Guide," and only lack of funds prevents the issue of the three concluding numbers of the series. The first edition of this work is now all but exhausted.

3. INSECT PESTS ACT.—The administration of this Act is one of the greatest demands on the resources of the department. We have now seven ports, from Esperance to Geraldton, at which fruit may be imported, and has to be inspected, employing twelve permanent inspectors, besides additional occasional labour when extra large shipments are received. During the past year 135,659 trees and 71,702 cases of fruit were imported into this State, every bundle and every case of which had to be inspected and treated by our inspectors. The fees received from this source alone amount to £2,140. Besides the port inspectors, we have five men constantly

travelling about the country inspecting the orchards and vineyards, and one to inspect the fruit offered for sale in the auction rooms and shops in Perth and Fremantle. During the past year the inspectors visited over 700 orchards and vineyards, and examined an aggregate area of, say, 5,000 acres. We have 2,700 orchards and vineyards registered on our books, and the number is increasing annually. To arrive at a fair conception of the work these inspections cause, it must be borne in mind, that the places visited are scattered over the whole of the South-West Division, from Esperance to the Murchison River. In addition to this, every inspector's report has to be registered at the head office, and in some cases as many as seven forms sent out. This work is not included in the correspondence referred to in paragraph 1. Under this Act we have also to take charge of any imported vine cuttings, which have to be quarantined for at least one year before being distributed to their owners. This necessitates the upkeep of the quarantine station at Subiaco, which is also occasionally utilised for the purpose of pasturing live stock, and for the experimental cultivation of grasses, etc., with a view to testing their hardiness on poor and sandy soils.

4. Noxious Weeds Act.—Under this Act, during the past year, 32 districts were visited, 1,250 places reported on, and, owing to the cumbersome nature of the Act, 6,000 notices and over 8,000 forms had to be made out and despatched. This is not included in the ordinary correspondence work referred to in paragraph 1. This work, if the necessary funds are forthcoming, will be largely increased in the future.

5. Contagious Diseases (Bees) Act.—We have also the administration of this Act, under which some 150 beekeepers are registered with the department. The hives of these bee farmers have to be inspected and reported on at intervals.

6. Fertilisers and Feeding Stuffs Act.—The administration of this Act also falls to the lot of this department, which is responsible for all the analyses required under the Act.

7. Experimental Plots.—A considerable amount of work has been done in connection with experimental plots. Besides the experimental plot at Hamel, with which the Minister is conversant, experiments were carried out in various parts of the State by private individuals under the direction of the department, to whom we supplied seeds and manures, with a view to testing the drought-resisting qualities of certain wheats, grasses, etc. Thousands of packages of seeds, from half an ounce to a bushel, either the produce of the experimental plots or imported from foreign countries, have been distributed by the department to parks and gardens' committees, agricultural societies, State schools, and individuals all over the State. A considerable number of vines rooted at Subiaco have also been sent out to State schools, goldfields wardens, and private individuals in order to test the limit of growth.

8. Paris and Glasgow Exhibitions.—This department was made responsible for the collecting of the agronomic exhibits for the Paris and Glasgow Exhibitions. This involved a large amount of work in collecting, classifying, analysing, packing, and despatching. We have also sent samples of the country's produce to the Philadelphia Commercial Museum and the Smithsonian Institute, Washington, and the Imperial Institute, London, as opportunity has offered; and recently we made up a collection for the Museum of Commerce at Rouen, France. The Cork Exhibition is now engaging our attention.

9. Entomological.—Our collections of useful and noxious insects, and their parasites, are continually being added to, and their proper classification and preservation takes up a good deal of time. The question of importing parasites of our worst insect pests is now engaging attention.

10. Botanical.—The same remarks apply to the very numerous specimens of introduced and indigenous plants throughout the State, the herbarium being daily added to, and the time of the Government botanist being fully occupied. All the recent exploring expeditions have made collections for the department, and added considerably to our knowledge of the native flora. The Government botanist is in communication with his *confrères* all over the world, and the correspondence which he conducts himself is considerable, and not included in that referred to in paragraph 1. Some useful work has been done in the matter of investigating the poison plants of the State, with a view to isolating the poison, and discovering antidotes; and although no definite conclusions have as yet been arrived at, the work is being continued with the assistance of the analytical staff of the Imperial Institute.

11. Dairy Work.—During the past few months the time of the dairy expert has been taken up attending the various shows with his working dairy plant and magic lantern, and in lecturing at the shows, and in other localities, on dairying, poultry farming, bee-keeping, etc. During the winter months he devoted a considerable portion of his own time to lecturing in the Perth City Markets to large and appreciative audiences. Lectures illustrated by lantern views have also been given in the goldfields centres, and have, without doubt, attracted much attention to the land, and disabused the minds of many goldfields residents of the idea that this State is all sand. Some 130 lectures have been delivered during the year by the experts of this department.

12. Annual Conference of Producers.—In March last, we had the annual conference of producers, when some 150 delegates from all parts of the State assembled in the museum of this department for the purpose of discussing matters of general interest to themselves. The preparation of all the details in connection with these conferences always calls for extra effort on behalf of the staff.

13. National Show.—Last year, in connection with the conference, was held the first annual national show, which, notwith-

standing many serious inconveniences, and the fact that it was the initial effort, proved a complete success.

14. Refrigerating Works and Markets.—In addition to the foregoing, we have also the Government Refrigerating Works and the Perth City Markets under our control, both of which require constant supervision.

15. Stud Stock.—We have also a large number of head of stud stock distributed over the country, which have to be shifted about and examined periodically.

16. Identification Work.—The identification of the numerous entomological, botanical, and pomological specimens sent in for that purpose, and reporting on same, takes up a considerable portion of the time of the various experts while at head-office. The experts have also to make monthly contributions of original matter for publication in the "Journal."

I think the Minister will gather from the foregoing that we have plenty to do; in fact we are sadly short-handed, and a reference to the Estimates will show him that we are all poorly paid, and have received little encouragement in the past to persevere. We have a great deal of unpleasant work to perform, which naturally brings us into conflict with the public, but in the interests of the State someone must do it, and we do not mind if we only receive a little encouragement to persevere. The work of the department is daily on the increase, and its scope might be greatly enlarged if funds and encouragement are forthcoming.

NEW MILKING MACHINE.

The Secretary of the Department of Agriculture has received particulars of the "Lawrence-Kennedy" Universal Cow-milking Machine. The price of the machine is £27 10s. Steam power is required to work it. From information to hand, the machine has apparently given every satisfaction wherever it has been installed. The Secretary will be pleased to give any further particulars he has, to those enquiring. A copy of the illustrated pamphlet issued by the patentees can be seen at the Department.

UNIFORMITY OF WOOL.

An End to be Sought by Careful Selection in Breeding.

Professor Thomas Shaw, writing to the *Weekly Chronicle*, U.S. America, says:—Uniformity in a fleece of wool adds much to its value. But to understand its value, it is necessary to know what is meant by uniformity. It has reference to several phases, bearing on quality more or less directly, as, for instance, similarity with reference to distribution over the body, similarity in fineness of staple, similarity in length, and similarity in density and elasticity. These are the more prominent of the essentials in uniform wool.

When the wool is possessed of much resemblance in character over all parts of the body, it is said to be uniform as to quality. Frequently it is not thus distributed as to that feature. Sometimes wool will be fine on certain points of the body and quite coarse on certain other parts. Sometimes it is soft on certain parts and harsh on other parts. Sometimes it is not uniform in curl, and sometimes it is not uniform in crimp. The greater the resemblance in all essentials in the various properties which appertain to it over all parts of the body the more uniform it is in quality.

When the wool in the fleece is nearly equally fine at the shoulder, ribs, hips, thighs, and rumps, it is said to be uniform as to fineness. Oftentimes it will be fairly fine on the ribs and at the shoulders, and very coarse at the hips. Frequently it is fairly fine at the shoulders and is very coarse at the rumps. Unevenness of character in this respect is very objectionable, since it causes a grading of the various parts of the fleece with reference to the uses that are to be made of it, which is positively troublesome.

When the length in the wool is nearly the same at the shoulders, hips, backs, sides, and thighs, it is said to be uniform as to length. It is of course scarcely possible to get wool of equal length over all parts of the body, but the more nearly the different parts resemble each other, the more uniform it is as to length. Wool is usually shorter on the belly than on the back, but it is not desirable to have great difference in this respect. When it is nearly equally elastic at the shoulder, loin, and rump, it is said to be uniform in density. These parts are taken as representative of the whole. The elasticity may be judged of by pressing the palm of the hand downward when spread over the surface of the fleece. When there is a strong resistance to pressure from the hand, or when the wool, when thus pressed down, does not readily regain its normal place, it is not elastic, but when it readily regains its normal position, it has this quality.

Uniformity in wool may be obtained through careful breeding, with a view to that end sought, aided by the most careful selection. Great improvement may thus be secured in a few generations, by giving the matter the attention which its importance demands.

A CONTRAST IN CONFORMATION: HUNTER v. SHIRE.

A Lecture delivered at the R.A.C., Cirencester, on July 17th, 1901.

My subject is one of great interest to all lovers of horses, and yet conformation as a science has been and still is greatly neglected in this country. There is a very prevalent fallacy in the British Isles by which each individual thinks himself a born judge of a horse. People with this idea pretend to despise the use of the tape measure on horses, and loudly express the opinion that it is impossible to teach a man to be a judge of a horse. But, although readily granting that some amount of what may be called natural instinct is necessary, it is obvious that even persons possessing this instinct will benefit considerably by a little scientific training. It is interesting to add that the Royal Commission on Horse Breeding make use of the tape measure, and that all the premium-winning stallions at the Hunters' Improvement Society's Show are submitted to its impartial judgment. On the continent, much valuable work has been done in putting the subject of conformation on a scientific basis, and particular mention must be made of M. M. Goubaux and and Barrier's Book, "The Exterior of the Horse."

In England the only serious attempt to deal with this subject has been made by Captain M. H. Hayes, F.R.C.V.S., and it is to his very excellent book, "Points of the Horse," that I am indebted for much of the information I shall lay before you.

Conformation may be said to treat of the shape, size, and proportion of an animal in health, compared with others of its own species, both as a whole and in its parts. A knowledge of this is useful both for scientific breeding, and also for judging of the best types, having the greatest mechanical advantages for the various kinds of draught or carrying purposes.

In order to bring out more forcibly the interesting points, it is my intention to contrast horses of speed, as represented by the thoroughbred, and horses of strength, as represented by the shire; the modifications necessary for jumping power will be noticed along with the thoroughbred. It may be well to state that although the rules laid down are in the main correct, and should be the aim of the breeder, yet they are only general and the exceptions numerous.

First, to get a general idea of a horse, the following measurements will be found extremely useful, viz.:—*Height*, (*a*) at withers, (*b*) at croup; *Length*, from the point of the shoulder to the point of the buttock; *Girth*; *Depth of Chest*, from top of the withers to the brisket; and lastly the *Circumference*, (*a*) above and below the knee, (*b*) above and below the hock.

These being taken, one or two notable relations are seen to exist in horses of the same kind, and some remarkable contrasts appear in horses of different types and for different purposes.

Comparing Height with Length, in the thoroughbred the height (at withers) is generally two or three inches greater than the length, whilst in the shire the height is generally 7-10 inches less than the length.

Comparing Length of Leg with Depth of Chest, in the thoroughbred the depth from withers to brisket, applied to the fore-limb, only goes from the brisket to the bottom of the fetlock joint, whereas in the shire the " depth " is three or four inches greater than the length from the brisket to the ground.

Comparing Height at Withers and Height at Croup.—It may be stated that, other things being equal, the longer the hind leg the greater the speed. But if the hind legs are longer than the fore legs, more weight is thrown forward, and the animal soon wears in front. In a hunter, too, if the weight is too much on the forelegs the animal is unable to rise well at his jumps. Agreeably to this, we find that in the thoroughbred (flat racer) the heights are about equal, in the hunter and cart horse the height is greater in front. It may be noted that the American trotter, having little weight to carry and requiring great speed, is higher behind.

Comparing Width of Breast ("breast," not "Chest") or *Width between the Fore Legs;* Great width may be said to be due to development of the pectoral muscles and those muscles which unite the fore limb to the trunk, great strength of which is not needed in the thoroughbred, but is essential in a cart horse. Thus we find thoroughbreds and hunters possess narrow breasts, whereas shires are very wide and muscular.

Weight of Body, chiefly considered *in relation to the Limbs:* A saddle horse, racer or hunter, should be as light as possible in the body, or the legs are soon worn. If too heavy in front, the horse is sure to be heavy in hand. A cart horse such as a shire, however, needs relatively more weight to increase his power in draught, and working generally at a slow pace, and having little weight to carry, a worn condition of the limbs is not so easily produced. Thus a shire is heavy and massive, particularly in front. In this connection it is necessary to notice the position of the centre of gravity in a horse. Colin, the great French physiologist, says, "The centre of gravity is a point at the intersection of two lines, one vertical behind the xiphoid cartilage of the sternum, and the other horizontal through a line dividing the lower from the middle third of the body." Assuming this, it is found that the fore legs bear more weight than the hind legs, in the thoroughbred in the proportion of five to four, and this because of the long neck of the well-bred horse.

And now to consider the significance of some of the foregoing comparisons.

Length of Body.—For great speed and for jumping power, essentials in the thoroughbred and hunter, a horse must have a very free *forward reach* with the fore legs. To obtain this the centre of gravity—an ever-changing point—must move backwards quickly to lighten the forehand, and this is brought about by what may be called the rearing muscles, the muscles on the top of the loins and down the back of the thigh. If the shoulders are heavy, or *if the back is long* these muscles soon tire, and it is for this reason that a short body and back are essential in a thoroughbred or hunter. In a cart horse, on the other hand, since the line of action of the pull is from the collar, through the back bone and pelvis and down the hind limb, the flatter or straighter this line and the more direct the pull. Thus it is an advantage for a draught horse to have a body long as compared with his length of leg, and to be higher at the withers than the croup.

Width of Breast, or Width between the Fore Legs. In all paces, particularly fast ones, there is a tendency to *lateral displacement*, or *rolling*, due to propulsion alternately from one side and then the other. To prevent this displacement muscular effort is needed, and so it is impossible to use the maximum force for progression in a straight line, hence less speed is attained. Obviously the nearer the fore and hind limbs of one side are to their fellows of the other side, or the nearer each limb is to the vertical plane through the centre of gravity in the direction of the animal's length, the less the displacement, and other things being equal, the greater the speed. Thus in a thoroughbred, the breast can hardly be too narrow. On the other hand, width gives room for the development of massive muscles uniting the fore limb to the trunk, and is consequently a very desirable point in draught horses.

Position of Centre of Gravity.—It is a fact easily demonstrated that the lower the centre of gravity of a body the more stable its equilibrium. Now, stability is essential for an animal to put forth all its strength, so that a cart horse should have its centre of gravity low, or in other words should have short thick legs. During progression, the centre of gravity is constantly being displaced at all paces, in fact displacement of the centre of gravity is necessary to progression, and it will easily be perceived that "the greater the instability of equilibrium during each step at any pace, the greater will be the speed at that pace" (Hayes), or expressed differently, the more insecure the balance during movement, and the quicker will the limbs be advanced, *i.e.*, the greater will be the speed. Agreeably with this, the centre of gravity of the thoroughbred is high, because of the animal's long legs.

And now to pick out a few of the more important points in the conformation of separate parts.

Head.—The head should be proportionate to the body.

In the well-bred horse it should be fine, sharply chiselled, with a good wide forehead, and a straight or sometimes slightly concave

profile. In the shire, the head is coarser, and the profile is very commonly convex, *i.e.*, the horse has a "Roman nose."

Neck.—In a thoroughbred the neck should be lean and of a good length, for there is a relation between the length of the neck and of the muscles which move the fore limb, and so good length is necessary for speed. A thick short neck makes a horse clumsy and heavy in hand.

In a cart horse the neck is shorter and more massive, but should be long enough to allow of grazing. In all cases the throat and windpipe should be as wide and open as possible to allow of free breathing.

Trunk.—One of the most important points to which attention should be paid is the "*Spring of the Ribs.*" The ribs must be (*a*) a good length, (*b*) very well arched, so making the barrel very round behind the shoulder, and (*c*) well inclined backwards. If the last rib is long, well sprung, and well directed back, there will be little space in the flank, and the horse may be said to be "well-ribbed-up." The "*Depth of Body*" at the lowest point of the back should also be good, for a good depth, and good ribs account for great chest space, and so *staying capacity*, so essential in both thoroughbred and hunter. The term "slack-in-the-loin" is the opposite of "well-ribbed-up," and is used when the last rib is short and there is a big space left in the flank. A horse "slack-in-the-loin" usually has either too small a chest or too long a back, or both, and is generally unable both to gallop and to stay.

Withers.—This term is applied to the prominent part of the horse's back in front of the saddle-seat, and the elevation is due to the long dorsal spines of the vertebræ. Withers high and extending far back afford room for the attachment of powerful muscles to extend the fore limbs, and so make the animal strong in galloping. Good withers generally accompany sloping shoulders; low thick withers go with short upright shoulders. A thoroughbred should have withers high and extending a long way back. A shire should have withers lower and much thicker, the extra weight being an advantage in draught.

Width of Chest or *Width through the Heart* is essential for good breathing, and so for staying capacity.

Back and Loins should be short and as flat as possible from side to side behind the saddle. Flat loins show good development of the muscles, which move the hind limbs and are essential to speed, while a short back is necessary for weight-carrying power.

The Fore Limb.—A point worthy of note is the complementary relationship in the length of the bones. A long shoulder is generally accompanied by a short arm, a long forearm, a short cannon, and long pasterns. Similarly, in the hind limb, if the pelvis is long, there is usually a short thigh, a long tibia, and a short cannon. Returning to the fore limb, its objects are mainly (*a*) to carry

weight, (*b*) to raise the fore-hand, (*c*) to propel the body, but in carrying these out it is necessary to provide against wear of the limb itself. Without doubt concussion is the greatest cause of wear, and there is most concussion at fast paces, so that some provision to lessen it is needed in all animals used for speed, such as the thoroughbred and hunter. The natural provision is an oblique direction of some of the bones of the limb, and particularly the shoulder and pasterns. It is essential that both should be long and sloping in the thoroughbred. In the shire horse concussion is much less, because of the slower pace, in fact if a draught horse is only to be used at a walking pace more upright shoulders and short straight pasterns afford a mechanical advantage, whilst the extra concussion is too small to be of any moment. There remains still one important point to be mentioned in connection with the cannon or metacarpal region. The cannon must, in all cases, be as short as possible, and must not be "tied in" below the knee. In weight-carrying hunters it is essential that they should have a large amount of "bone" immediately below the knee. In other words, the measurement round the metacarpal region, including in the tape the metacarpal bones and the tendons of the limb, should be large. The term "tied in" is sufficiently expressive, and refers to the metacarpal region immediately below the knee. This is often the weakest point in the limb, and it is much preferable for an animal to be "fine" all the way down, than be "tied in" just locally. As mentioned above, the pasterns should be long and sloping in a racer; shorter and straighter, to increase the strength, in a shire. In all cases the foot must be a good open one, for there is a good deal of truth in the old saw, "no foot no horse."

The Hind Limb.—Space will not permit me to go into any detail with respect to the hind limb, so that only the more important considerations will be dealt with. The chief function of the hind limb is to propel the body, whilst at the same time it bears weight, although much less than the fore limb. Bearing less weight, the concussion is not so great as in front, and it is for this reason that the union of the hind limb to the trunk is bony and rigid through the medium of the pelvis, and not muscular and elastic as in the fore limb. For a similar reason, obliquity of the bones is not needed so much, and the pasterns and hoof are consequently much more upright than in front. For speed the hind limb must be long and must possess great power to quickly and forcibly extend, so that a long "straight-dropped" hind leg is very necessary in a thoroughbred. The conformation known as "sickle hocks," where the angle between the tibia and the metacarpal bones is reduced, and the hock appears partially flexed, is a bad fault in a thoroughbred, and detracts from the horse's speed. The pelvis, for speed, must be long, or in other words a racer must possess long straight quarters. The slope of the quarters varies; in a cart horse when pulling, the line of force is transmitted through the back bone, quarters, and hind limb to the ground, and the straighter this line, the more force is utilised, so that a sloping pelvis and a proportionately short hind limb are desirable. But the thoroughbred *must have*

a long hind limb to attain great speed, so that the pelvis must be horizontal. For jumping, on the other hand, it is essential that the horse should get his hind legs well under him when rising at a jump, and for this sloping quarters are useful, in fact this conformation is considered very desirable by many hunting men, and horses from the south of Ireland are commonly "goose-rumped." Many steeple-chasers, *e.g.*, "Soarer" also show this conformation. For both strength and speed, *i.e.*, in both shire and thoroughbred, the quarters and thighs should be very muscular, and the second thighs or "gaskins" should be wide and good. Below this point the hocks must be a good size, there must be no evidence of "tying in" below them, and otherwise the limb should be as described for the fore limb.

In conclusion, although fully aware of many important omissions, the object of the writer will be attained if interest has been awakened in a fascinating and yet neglected subject, viz., the accurate and intelligent observation of the comparative points of the horse.

H. A. Woodruff, M.R.C.V.S.,
Professor of Hygiene, Materia Medica, and Therapeutics,
Royal Veterinary College.

Appended Table gives measurements of four King's premium winners at the Hunters' Improvement Society's Show, 1901.

Name of Horse.	Height in hands.			Girth in feet and inches.	Length in feet and inches.	"Bone" below knee, in inches.
	At Withers.	Centre of Back.	At Croup.			
Irish Wake ... s. Master Kildare	15 3⅞	15 0	15 3⅞	6′ 0½″	5′ 2″	8½″
Belleville ... s. Hampton	16 0⅜	15 0½	16 0¼	6′ 0½″	5′ 4″	8¼″
Rampion ... s. Amphion	15 3¼	15 0¼	16 0⅛	6′ 1½″	5′ 5½″	8½″
Sterling Bank ... s. Friar's Balsam	15 2¼	14 3¾	15 3¼	6′ 1½″	5′ 5″	8¾″

SHEEP ON THE FARM.

Professor Lowrie, when speaking at the thirteenth congress of the Agricultural Bureau of South Australia, in September last, at Adelaide, touched, amongst other matters, on the value of a flock of sheep to the farmer. The "Journal of Agriculture" of South Australia reports what the professor said, as follows :—

"In this direction greater development is possible, and we can do more than we have done in the past through artificial manures. It is going to return money to us in a larger increase. I will give you an illustration of the value of this work, and the advantage gained from running sheep over the stubble land. This year I have 168 sheep and 104 lambs in a field of 150 acres, which must be considered good when the carrying capacity of the land previous to the use of these manures is taken into consideration. As far as I can read it, it seems to me to be able to carry from half as much again to double as much. That land, ten years ago, would not have carried one-third of this stock. (Hear, hear.) I question if that field could have kept fifty ewes and lambs satisfactorily. I know this very well--that it would not have been in anything like the condition it is in to-day. I am perfectly sure of getting 8s. an acre from that paddock from the sale of the lambs. See where the advantage comes in. From the lambs alone I am getting all the money paid for the manures that I used. It is in that direction of sheep, then, that we, as farmers in South Australia, must look for the special development of the future. We cannot forecast what the home market is to be, but we must take our chances in that; and from the experience of past years we are justified, at any rate, in believing that it will continue so, or something similar, in the future. (Hear, hear.) Our farmers are more appreciative of sheep than they were. I believe the farmer has come to realise the importance of the trade, and the fact that the sheep enrich the ground. We have practically three times the number of farmers keeping sheep now compared with a few years ago. A report of an address I gave ten years ago says :—'On a farm of 700 or 800 acres he saw no reason why there should not be a £50 or £60 wool bill, and £40 obtained from sheep otherwise. The owner ought to have upwards of £100 a year for his sheep, and be nothing the poorer otherwise.' That was in the days when the practice was neglected, and I was lecturing to a meeting of farmers in which I do not think there was one in twenty who kept sheep, and I was impressing upon them what a man could do on a farm of 700 acres. Sheep on a farm give you many advantages and profits which you could not otherwise obtain. So far as I can read, there is no industry in this State that gives so much promise as this matter of keeping sheep, and breeding the best sort of lambs for export; and even if the farm should be small, the farmers could keep a few sheep to advantage. You are getting the manure from your sheep, and so enriching

the land; You are getting the wool, and altogether you are getting a handsome return. I think that if it is properly understood that fat lambs, for export at any rate, are to be handled with the very greatest care we will see—I am still thinking I am going to stay in South Australia—our lambs here will be on a level with the best fat lambs frozen in any part of the world. I do not think anything can be sweeter or firmer or better. I know there is a farmer in this meeting who has been many years amongst sheep in Great Britain, and he reckons that our fat lambs are nicer and plumper than anything he ever had the opportunity of putting his hands on. I do not see why it should not be so. Lambs elsewhere are forced on artificial food stuffs. They are fed on fodder crops, the flavour of which would very soon be noticed in butter if cows were fed on them, and to a certain degree you get it in mutton. I have tasted beef that fattened on white mustard, and the mustard was in the beef.

"We have our natural vegetation, which is sweet, but if we will only feed our land as we ought to do we will get our lambs as fat and nice as it is possible for them to be; but if you send them down here and rush them through yards, and give them a kick as they go through, as men very often do, and lift them by the wool and throw them about, then South Australian lambs will never take first place in the home market. Lambs have to be handled as gently as if you were handling eggs or ripe peaches. However slight the bruise, if only the very faintest bloodburn, and though the manager of the produce depôt, or the Minister, who takes such a deep interest in it—a manager could not take more—although it may pass their eye (they think it is not much), when it goes out of the chamber it is a big black bluish blur. Let us think of that blot, let us handle these lambs as they should be handled, and let the proper stock be kept."

ON THE USE OF ACETYLENE GAS LAMPS IN TRAPPING INSECT PESTS.

Mr. E. E. Green, the Government Entomologist at Peradenya, writing to the *Tropical Agriculturist*, says:—"Some interesting experiments in trapping insects by means of Acetylene gas lamps have recently been conducted by Messrs. G. Gastine and V. Vermorel, in France. They have published the results of their work in a small pamphlet, of which the following is a *résumé*:—

"For several years the vineyards in the Beaujolais have been infested by a destructive Pyralid moth. Many vine-growers had tried without success to check the pest. The authors of the paper

attempted its destruction on the vineyard of Liergues, in July last, by means of illuminated traps. The lamps used were served with Acetylene Gas; the burner, with a naked flame, being fixed in the centre of a metal basin with a diameter of about 18 inches. This was partly filled with water covered with a film of petroleum; the burner projecting a few inches above the level of the water. The small generator was charged with 150 grammes (about $4\frac{3}{4}$oz.) of Calcium Carbide, which quantity kept the light in action for six or seven hours; the flame being of a little over one "carcel."* The generator supported the basin and was fixed on a post at a convenient height. The lamps were lighted between 8·30 and 9 p.m., and burned till daybreak. During the dusk it was found that few moths were captured. The big catches commenced after dark, when clouds of the moths were attracted by the brilliant light. Some were singed by the flame itself, but the greatest number precipitated themselves directly into the basins. When the insects are very numerous, a greater proportion of oil should be used to ensure their capture. The trials commenced on the night of 13th-14th July, with two lamps. One basin was accidently overturned; the other captured 4,650 of the moths, besides an assortment of other insects. On another night as many as twenty lamps were employed, a total of 64,000 moths being accounted for; giving an average of 3,200 for each lamp. The biggest catch in a single basin was 5,000. From the 13th to 31st July, 170,000 of the moths had been destroyed in this manner. The average proportion of the sexes was 42 per cent. females and 58 per cent. males.

"It is evident that such wholesale destruction of the moths must have a marked effect in checking the pest. This method of catching noxious insects deserves a thorough trial in Ceylon. It would be particularly applicable in such cases as "*Tort rix*" 1, "Nettle-Grubs" 2, "Red-slug" 3, and other pests due to the caterpillars of moths. Whether it would be equally effective against *helopeltis*, "Shot-hole Borer," and other miscellaneous pests, can only be proved by separate experiment in each case. I have tried small oil lamps, without result upon either *helopeltis* or shot hole borer. But insects that take no notice of a small light, may be readily attracted by a more powerful one. A special apparatus, with which I hope to conduct experiments against our various winged insect pests, is now being constructed for me."

[This has also been tried very successfully in this State with regard to cutworm, potato, and many other noxious moths.—Ed. Journal.]

*"Carcel" is the French unit of artificial illumination, and is equal to the light emitted by a standard lamp with a flame 40 mm. high and burning 42 grammes of colza oil hour."

GARDEN NOTES FOR FEBRUARY.

By Percy G. Wicken.

This is the most trying month of the year for growing vegetables, and, except in the South-Western portions of the State, or in a few favoured moist positions inland, the supply of vegetables will be very short. The heat is in most parts very great, and unless water for irrigation purposes can be obtained and used judiciously, vegetables are hard to obtain. Much, however, may be done by deep cultivation, keeping the surface well stirred, and the liberal application of stable manure for mulching purposes. Insect pests are likely to be troublesome, especially the Fruit-fly maggot. A sharp look out should be kept for this maggot, and any fruit found infested should be at once destroyed.

Keep the ground well stirred, and hoe out all weeds. A number of plants will now be coming into seed. Go round these plants and put a mark on the best and those that are true to name, so that you can save the seed from them. Always save the seed from the best and healthiest plants. All weeds cut down this month should be raked up and burnt, or else placed on the compost heap, as many of them mature their seeds after being cut down and distribute them over the ground. By burning or placing on the compost heap, this is prevented and the seed destroyed.

All growers should be looking out for exhibits to show at the National Show next month, and those having perishable exhibits should send them to the Government refrigerating works, where they will be taken charge of and stored free of expense. Franked labels may be obtained on application to the Secretary, or the Secretary of the local society.

Beet (Red).—A little seed may be sown. It requires a fairly rich ground, which has been well manured for the previous crop. Cover the seed about one inch deep and make the drills about three feet apart, and when well up thin the plants out to about 12 inches apart.

Beet (Silver).—This is an excellent vegetable to grow during the hot weather. Sow the same as for Red Beet, or it may be sown in a seed bed and planted out. It requires fairly rich soil and plenty of well-rotted manure. The leaves of this plant are eaten, and also used for feeding stock. After the leaves are cut off, fresh ones grow in a very short time.

French Beans should now be bearing well, and require to be well hilled up. Except in very favoured localities it will be very little use planting out now.

Madagascar Beans should now be in full bearing. Leave some pods on the vine so as to mature a supply of seed for next year.

Lima Beans ought to be plentiful. Use all you can green, and let the remainder stop on the vine until thoroughly ripe, when the vines may be pulled up and the beans threshed out with a flail. They can then be sold for seed or put by for future use. They are almost as nice dried as when fresh.

Cabbage and Cauliflower.—Make seed-beds large enough to produce sufficient plants for planting out later on. Where sufficiently moist, a few plants may be put out at once, but they will require to be shaded from the sun. Get the land well worked ready to plant out after the rain.

Carrots.—A small quantity can now be sown. The ground requires to be deeply worked, and no fresh manure should be applied, as this causes the roots to become forked. Some land that has been heavily manured for the previous crop is best. Cover the seed with very fine soil.

Melons, Water, Rock, and Preserving.—These should now be in full bearing. Always cut melons as early as possible in the morning, before they get warm; they will carry and keep much better. Preserving melons, sliced or pulped and mixed with chaff, are excellent feed for cattle.

Maize should now be getting ripe in the warm districts, but should not be pulled until thoroughly dry.

Sorghum will require to be hilled up and well cultivated. A little more may be sown for late feed.

Pumpkins.—Those that are ripe should be stowed away in as cool a place as possible for future use.

Sweet Potatoes.—Keep the land well stirred between the rows, but not close enough to tear down the hills and disturb the roots. A few may be ripe enough for home use at the end of the month, but the bulk will not be ready until next month.

Tomatoes.—Plentiful supplies of this fruit are now to hand. Pick off and destroy all diseased fruits so as to prevent the spread of disease.

Turnips.—Plant out a plentiful supply of this crop. Those down last month will now require thinning. Thin out to at least 16 inches apart, so as to allow good roots to grow.

Farm.—Harvesting is now over, and the principal operations consist of threshing, winnowing, and chaff cutting. Keep a look-out for bush fires, and plough fire breaks round all stacks not already protected. In travelling round the farming districts, I notice many people carrying out the practice of cutting up the string bands with the chaff. This causes the death of many horses, and anyone found doing this should be dealt with by law. Chaff is what is supposed to be sold, not string. It is only laziness on the part of the cutters where this is not done. It is just as easy to cut the band and pull the string off as to put it through the machine, and the string will be found very useful on the farm

during the year, quite equal to the value it fetches when sold as chaff. I have seen farmers sowing their chaff bags with the string taken from the bands. This is an economical practice and much to be recommended. Wherever practicable the land should be ploughed as soon as possible, and left fallow until time to sow the next crop. Those who require feed for their sheep during the winter should now sow kale, rape, mustard, etc. I have been very successful with mangels sown during this month.

ANSWERS TO CORRESPONDENTS.

Mr. F. C. Woods, Waterloo, writes:—"I am forwarding you a beetle for identification. A settler in this district has lost a quantity of apples about three parts grown, which fall from the tree, apparently been bitten off, or scooped close to the stem. The beetle has been found amongst the fruits and seems to be the cause of the mischief." The matter being referred to Mr. Inspector Compere, he replies as follows:—"The insect received from Mr. Woods, is not, as he mentioned in his letter, a beetle, but is a species of Cuckoo-fly, belonging to the family *Chrysididæ*. This is not in any way responsible for the damage to the apples complained of by Mr. Woods. The following very interesting account of the family to which this species belongs is to be found in Professor Comstock's manual for the study of insects. 'The Cuckoo-flies are wonderful creatures; being usually a brilliant metallic green in colour. The species are of moderate size, the largest being only about a half inch in length. They can be distinguished from other Hymenoptera by the form of the abdomen, in which there are only three or four visible segments, except in the male of a single genus (*Cleptes*), where there are five. The abdomen is convex above and flat or concave below, so that it can be readily turned under the thorax and closely applied to it. In this way a Cuckoo-fly rolls itself into a ball when attacked. Although these insects are handsome, they have very ugly morals, resembling those of the bird whose name has been applied to them. A Cuckoo-fly seeks until it finds one of the digger wasps, or a solitary true wasp, or a solitary bee, building a nest, and when the owner of the nest is off collecting provisions, steals in and lays its egg, which the unconscious owner walls in with her own egg. Sometimes the Cuckoo-fly larva eats the rightful occupant of the nest, and sometimes starves it by eating up the food provided for it. The bees and wasps know this foe very well, and tender it so warm a reception that the brilliant coated little rascal has reason enough to double itself up so that the righteous sting of its assailant can find no hole in its armour. There is one instance on record where an outraged wasp, unable to sting one of the Cuckoo-flies to death, gnawed off her wings and pitched her out on the ground. But the undaunted invader waited until the wasp departed for provisions, and then crawled up the post and laid her egg in the nest before she died. Some of the Cuckoo-flies are true parasites; one of them infests the currant-worm in Europe.' It is very likely that the specimen sent in by Mr. Woods is parasitic upon the insect that caused the damage to the apples complained of."

Mr. C. Faul, Collie, writes:—"I am sending you some diseased tomatoes, please let me know what is wrong with them. The plants are growing in sandy soil, and are supported by trellis work." The matter was referred to Mr. Inspector Compere, who reports as follows:—"Some diseased tomato specimens received from Mr. Faul were found to be attacked by two species of fungus disease, and other specimens showed signs of having also been attacked by insects. There were none of the insects present, but from the nature of their attack it is probably the work of cut-worms (*Heliothis armiger*), or one of its closely allied species, which are all destructive to the plants as well as the fruit. They will commence feeding upon the plants when the latter are quite young. They are slender, hairless grubs, varying somewhat in colour from light green to brownish olive, and about an inch or an inch and a quarter in length. During the day the grubs will be found hidden in the ground near the roots of the plants, crawling up the foliage by night, and gnawing holes into the fruit to feed upon the seeds. When full grown they pupate beneath the surface of the soil. The moths are a greyish brown. Treatment: — Mix one ounce of Paris green, 2½lbs. of bran or pollard, one pound of treacle into a paste with water, and make into small pieces about the size of pigeon eggs, and place them under the attacked plants, about half buried in the ground. The grubs will readily feed upon this poisoned bait. *Great care must be taken that domestic animals do not eat this mixture.* One of the species of fungus disease attacking these tomatoes is known as tomato rot (*Marcrosporium tomato*, Cook). This first appears generally as a brown blotch at the blossom end of the fruit, when it is about one-half or two-thirds grown. The blotch will increase in size with the growth of the tomato until the upper half of the fruit is destroyed, becoming black and sunken. Treatment:—Spraying with Bordeaux mixture early in the season, which will check the disease to a great extent, and any fruit showing signs of the disease should be at once removed from the plant and destroyed. If it should be found that the disease still continues to spread, infected plants should then be rooted out and burnt to prevent it spreading to adjoining plants. The second species of fungus that the specimens were found to be attacked by is known as "Pimple Rot." This disease appears on a flattened circular area in the form of concentric rings. Remedy:—Destroy all affected tomatoes by burning them. Should any be left about the ground they will spread the disease. Seeds from affected plants should never be sown, and do not plant tomatoes repeatedly on same plot."

Mr. R. H. Playne, Kings River, writes:—"Will you please tell me if there is any difficulty in grafting vines with another variety? If not, I shall be glad to know the best way to proceed about it." The matter being referred to the horticultural and viticultural expert, Mr. Despeissis replied: —"There is no difficulty whatever in grafting vines, if the work is done at the right time, viz., just when the sap is rising and the buds are about to burst, in spring. Most European vines take readily on one another. Some American stocks unite more readily with some European varieties than others. The whole question is reviewed in the second edition of the 'Handbook of Viticulture and Horticulture of W.A.,' which will be issued in a few months' time, and long before the grafting season is in."

MARKET REPORT.

For Month ending 8th February, 1902.

Messrs. A. L. Ballantyne & Co., Produce Merchants and Commission Agents, City Markets, Perth, report sales in undermentioned lines for the month ending 8th February, 1902.

Farm Produce – Chaff: market has been fully supplied past month; quality satisfactory. We obtained £3 17s. 6d. to £4 7s. 6d. for all prime lines received; £4 10s. for few trucks, special quality; inferior and medium quality, £3 to £3 12s. 6d. per ton. Bran: market has ruled £6 15s. to £7 per ton, market very firm. Pollard: market very bare, prices £6 15s. to £7 per ton, now firm at £7 2s. 6d. per ton. Maize, 4s. 6d. to 4s. 8d. per bushel. Barley, 3s. 4d. to 3s. 6d. per bushel. Peas, 5s. 6d. to 6s. per bushel. Oats, several lines local Algerian sold 3s. 4d. to 3s. 6d. per bushel; New Zealand stout oats, 4s. to 4s. 3d. per bushel. Flour: prices in Eastern States have advanced to £7 5s. per ton f.o.b., which means over £10 per ton landed here. Local flour, selling freely, £9 7s. 6d. to £9 10s. per ton. Potatoes: local crops appear to be about cleared, prices value £7 10s. to £8 per ton; imported potatoes unsatisfactory, being shipped too green, selling at £6 10s. to £7 per ton. Onions: market firmer, local and imported selling at £7 per ton.

Dairy Produce.—Butter: market firm, very few lines of local make being offered; price 1s. 1½d. to 1s. 3½d. per lb. Imported butter, 1s. 1d. to 1s. 3d. per lb. Bacon, selling freely; sides, 10¼d. to 11d. per lb. Hams, stocks exhausted; worth 1s. 1½d. to 1s. 2d. per lb. Eggs: market has fluctuated a good deal past month, 1s. 6d. to 1s. 9d. per dozen, but market has now firmer tendency. Imported eggs, 1s. 1d. to 1s. 2d. per dozen; immense quantities of eggs have to be imported to supply orders. Honey, demand dull, 60lb. tins selling 12s. 6d. to 15s. each.

Fruit.—The fruit season is now in full swing, and prices are lower than have ruled hitherto in this State. Apples: several lines of imported have been placed on the market past month, but unless some better method is adopted of shipping and packing, the West Australian orchardists have little cause to fear the competition. Many lines of imported apples did not realise the cost of freight, landing, and handling; prime local apples selling to 18s. for prime table varieties. Cooking apples, 3s. 6d. to 7s. per case. Pears, 5s. to 8s. per case. Peaches, 10s. to 18s. per case. Nectarines, 5s. to 10s. 6d. per case. Grapes, Sweet Water variety and wine grapes, 2s. 6d. to 4s. 6d. per case; Muscatel grapes, 6s. 6d. to 8s. 6d. per case. Imported lemons, 12s. 6d. to 18s. per case. Imported oranges, 18s. to 20s. per case.

Vegetables.—Supplies falling off. Cabbage, 4s. to 5s. 6d. per cwt. Beans, 1d. to 2d. per lb. Pumpkins, 5s. to 7s. per cwt. Rock Melons, 4s. to 10s. per doz. Water Melons, 4s. to 12s. per dozen. Tomatoes, very plentiful and cheap, 1s. 6d. to 3s. 6d. per case. Rhubarb, ½d. to 1d. per lb. Cucumber, 9d. to 1s. per dozen. Turnips, Carrots, and Raddish, 1s. 3d. per dozen bunches.

Poultry.—Demand dull; good table fowls, 5s. 9d. to 6s. 6d. per pair; other lines, 5s. to 5s. 6d. per pair. Chickens, 2s. 6d. to 3s. 9d. per pair. Ducks, market oversupplied with poor quality. Prime Ducks worth 6s. 6d. per pair; others, 4s. 6d. to 5s. 6d. per pair. Turkeys, 18s. to 26s. per pair; Turkey hens, 9s. to 12s. per pair. Geese, 9s. to 10s. per pair.

Live Stock and Carcase Meat.—Pigs: we sold several large lines past month at satisfactory prices; one line of 50 medium stores realised 20s. 6d. each; prime porkers, up to 35s. each; forward stores, 24s. to 28s. each; backward stores, 14s. to 18s. each; slips, 10s. to 11s. each; suckers, 6s. 6d. to 8s. each; heavy pigs, for chopping, 50s, to 60s. each. Carcase pork, 6d. to 6¾d. per lb. Lambs, 8s. to 9s. each. Mutton, 4½d. to 4¾d. per lb. Vealers 5d. per lb.

Annual Returns of Fruit and Fruit Trees and Plants, Imported into Western Australia during 1901.

The attached returns of fruit importations, for the past year show a considerable increase in the quantity of fruit shipped to this State. In reference to the tabulated figures it will be seen that, with the exception of apricots, lemons, rhubarb, and fruits other than those named in the return, all kinds of fruit show an increase over the preceding year. The removal of the restrictions on the introduction of apples and pears, accounts for an increase of 14,682 cases out of a total increase of 35,250 cases of all kinds of fruit.

It will be seen that 8,927 cases of fruit were destroyed, of which 7,079 were decayed, and 1,848 diseased; the percentage of fruit actually condemned by the inspectors on account of disease therefore works out less than ·3 per cent. of the total importations. In the matter of disease, the apples have been the chief offenders, more than half of the fruit condemned being apples. The larger percentage of this fruit condemned is explained by the fact that every case in which traces of codlin moth is found is destroyed, whereas in the case of other diseases the affected fruit is picked out and destroyed, and the balance delivered to the importer. Other diseases found on imported fruits include *mytilaspis pomorum*, or mussell scale on apples, *mytilaspis citricola*, *chionaspis* scales and *melanose* on oranges and lemons. These diseases, in common with the codlin moth, are not known to exist in this State, and it is hoped the inspection and disinfection exercised at the ports will effectively check their introduction.

Taking two tons of fruit per acre as a fair average return, it will be seen that the importations for the past year represent the crop grown on an area of 717 acres, of this the apples imported would require 142 and the oranges 212 acres, these two fruits representing half of the total imports.

FRUIT TREES.

The importations of fruit trees and plants for the same period show a small increase of 1,007 trees, the most notable increase being apples, of which 55,575 were imported as against 38,808 during 1900, an increase of 16,767, while pears show a decrease of 5,599.

Leaving out of the calculation, ornamental trees and plants, and small fruits, and allowing 100 trees to the acre, it will be seen that the importation of fruit trees for the year represents an increased area under cultivation of 963 acres of fruit trees and 19 acres of

vines. In addition to these figures has to be added the fruit trees and vines grown by local nurserymen, so that an area considerably exceeding 1,000 acres must have been added to the orchards in the State during the past year.

The latest figures—supplied by the Registrar General—show, at the end of 1900, an area of 5,296 acres of fruit trees under cultivation, of this area only 2,159 acres are described as productive, the remaining 3,137 acres being orchards that have not reached maturity. To this must also be added the area planted during 1901, say, 1,200 acres, making a total of 6,496 acres, of which less than half are in bearing. It is interesting to note that of the total area, no less than 2,682 acres have been planted under apples, and of these only about one-third are at present in bearing, so that a largely increased local supply of this fruit may be confidently predicted.

When the total area at present under fruit trees reach the bearing stage, a return of two tons per acre would give 650,000 cases of fruit per annum, or, including the product of 1,200 acres of table grapes at the same rate, a grand total of 662,000 cases.

From the foregoing figures it will be seen that the prospect of Western Australia being independent of outside supplies of fresh fruits is by no means remote, provided that insect pests and other diseases are not permitted to obtain an ascendency. With the exception of the Mediterranean fruit fly and the San José scale, this State is fortunately free from the pests which most seriously affect fruit crops in other parts of the world. Neither have the diseases mentioned succeeded in thoroughly establishing themselves throughout the State. The ravages of the fruit fly do not extend much beyond the metropolitan area, though it causes great loss to orchardists in the vicinity of the city, large quantities of fruit in the gardens being gathered and destroyed as unfit for market. In the case of the San José scale, strenuous efforts have been made during the past year to locate and eradicate it. This pest has already been dislodged from over two hundred orchards, and there is every reason to believe that this disease will be ultimately stamped out of the State.

G. BUCHANAN,

Acting Chief Inspector.

Return of Fruit Imported into Western Australia during 1901.

	1901.				1900.		
	No. of cases received.	No. diseased.	No. decayed.	Total cases destroyed.	No. cases received.	Increase.	Decrease.
Apples	14,252	1,080	1,688	2,768	...	14,252	
Apricots	140	48	40	88	227	...	87
Bananas	13,826	...	1,656	1,656	5,444	8,382	
Cherries	3,457	...	452	452	2,587	870	
Gooseberries ...	777	...	120	120	616	161	
Lemons	9,803	78	497	575	10,490	...	687
Oranges	21,253	604	2,363	2,967	12,285	8,968	
Passion Fruit ...	1,716	3	48	51	816	900	
Pears	430	35	41	76	...	430	
Plums	5,405	...	112	112	3,671	1,734	
Pines	283	...	34	34	...	283	
Rhubarb	18	...	...	...	22	...	4
All other	342	...	28	28	414	...	72
Totals ...	71,702	1,848	7,079	8,927	36,572	35,980	850

Return of Fruit Trees and Plants Imported into Western Australia during 1901.

	1901.	1900.	Increase.	Decrease.
	No. received.	No. received.		
Apples	55,575	38,808	16,767	
Almonds	341	6,456	...	6,115
Apricots	1,887	1,839	48	
Cherries	584	2,638	...	2,054
Figs	489	288	201	
Lemons	415	1,857	...	1,442
Mulberries	475	420	55	
Oranges	15,367	13,256	2,111	
Peaches	10,445	10,065	380	
Pears	4,014	9,613	...	5,599
Plums	2,839	3,817	...	978
Grape Vines	11,750	7,000	4,750	
Small Fruits	7,617	13,022	...	5,405
Ornamental Trees and Plants	19,901	18,873	1,028	
All other Trees	3,960	6,598	...	2,638
Totals	135,659	134,550	25,340	24,231

RAINFALL FOR THE YEAR 1901.

The following table shows the rainfall for last year throughout the State. Returns from very distant places are not yet to hand, but it is considered advisable to publish the report now rather than wait for these to come in.

The following very brief notes for each month will give an indication of the general character of the season in the Southern portions of the State:—

January.—Only a few light showers.

February.—Only a few light showers in West and South-West districts. Very heavy throughout the Murchison and Goldfield's districts.

March.—Heavier than usual, but most of the rain fell during the last week of the month.

April.—Considerably below the average.

May.—Very heavy on the West coast; fairly heavy in central agricultural areas; very light on the goldfields.

June.—Normal in West central districts; below the average in the South-West and throughout the goldfields; unusually heavy in the North-West.

July.—Normal; phenomenally heavy in the North-West.

August.—Very wet in the extreme South-West, otherwise about normal.

September.—Generally below the average.

October.—Much lighter than usual.

November.—Very light.

December.—Very light, except in the extreme South.

RAINFALL for the Year, 1901.

(Completed as far as possible.)

Stations.	No. of points. 100 = 1in.	No. of wet days.	Stations.	No. of points. 100 = 1in.	No. of wet days.
East Kimberley:			North-West—*contd.*		
Wyndham	2,064	—	Bamboo Creek ...	2,124	35
6-Mile	2,079	38	Marble Bar	2,185	46
The Stud Station ...	—	—	Warrawoona ...	2,191	45
Carlton	1,488	54	Corunna Downs ...	1,394	40
Denham	—	—	Nullagine	2,050	37
Rosewood Downs* ...	2,654	38	Yandicoogina ...	—	—
Argyle Downs* ...	2,113	44	Tambourah	—	—
Lisadell	—	—	Kerdiadary	—	—
Turkey Creek ...	2,870	57	Roy Hill	996	29
Plympton St. Mary	1,764	—	Mosquito Creek ...	—	—
Koojubrin	—	—	Mulga Downs* ...	450	12
Hall's Creek ...	1,825	—	Woodstock*... ...	2,162	35
Flora Valley ...	—	—	Mt. Florence* ...	1,051	13
Ruby Creek ...	—	—	Tambrey*	1,099	25
Ruby Plains ...	—	—	Millstream	1,349	26
Denison Downs ...	2,146	—	Yandyarra	—	—
			Mallina	1,481	20
West Kimberley:			Whim Creek ...	1,448	22
Obagama	2,383	44	Cooyapooya* ...	831	22
Derby	1,374	38	Woodbrooke* ...	1,040	17
Yeeda	—	—	Croydon	1,338	29
Liveringa*	1,556	33	Balla Balla	1,426	28
Mt. Anderson* ...	1,446	36	Roebourne	834	26
Leopold Downs* ...	1,850	41	Cossack	803	24
Fitzroy Crossing ...	2,304	51	Fortescue	268	18
Fitzroy (C. Blythe)	—	—	Mardie	298	11
Quanbun*	1,982	36	Mt. Stewart* ...	1,087	21
Nookanbah	—	—	Yarraloola	217	6
Broome	3,405	48	Chinginarra ...	627	8
Roebuck Downs ...	—	—	Onslow	259	16
Thangoo	—	—	Peedamullah ...	1,091	19
La Grange Bay ...	2,532	46	Red Hill	1,249	26
			Mt. Mortimer* ...	614	21
North-West:			Wogoola	692	17
Wallal	2,158	42	Nanutarra	692	20
Condon	2,450	33	Yanrey	—	—
DeGrey River ...	2,003	27	Point Cloates* ...	868	23
Port Hedland ...	2,348	30			
Boodarie	1,801	18	Gascoyne:		
Yule River	—	—	Winning Pool ...	809	21
Warralong	1,695	43	Towara	674	20
Muccan*	1,444	39	Ullawarra	728	21
Ettrick	—	—	Maroonah*	921	18
Mulgie	2,188	36	Thomas Police Station	—	—
Eel Creek	—	—	Bangemall*	541	18
Coongon	1,622	29	Mt. Augustus ...	—	—
Warrawagine* ...	1,426	33	Minnie Creek* ...	517	16
Braeside	—	—			

— Signifies "returns incomplete." * Eleven months only.

RAINFALL FOR THE YEAR—*continued.*

Stations.	No. of points. 100 = 1in.	No. of wet days.
GASCOYNE—*contd.*		
Yanyeareddy*	746	13
Williambury* ...	520	19
Wandagee*	937	25
Bernier Island ...	—	—
Boolathana* ...	620	16
Carnarvon	584	22
Cooralya*	511	17
Doorawarrah ...	—	—
Mungarrah	465	20
Clifton Downs ...	531	21
Dairy Creek* ...	246	—
Mt. Clere	—	—
Errivilla	384	8
Dirk Hartog Island*	1,014	47
Sharks Bay	499	23
Kararang*	1,029	46
Meedo*	410	17
Tamala	1,006	51
Wooramel	336	20
Hamelin Pool ...	461	32
Byro	284	23
Yarra Yarra* ...	227	8
Berringarra ...	261	16
Mt. Gould	298	13
Moorarie	—	—
Peak Hill	774	27
Horseshoe	—	—
Abbotts	695	33
Belele*	141	10
Mileura	351	12
Milly Milly	—	—
Manfred	182	16
Meelya	461	16
Woogorong	238	12
Boolardy*	309	7
Billabalong* ...	444	18
Wooleane	256	14
Murgoo	345	10
Meka	468	25
Mt. Wittenoom ...	375	24
Nannine	568	17
Star of the East ...	678	20
Annean	290	—
Tuckanarra	617	24
Coodardy	—	—
Cue	481	27
Day Dawn	454	20
Lake Austin ...	559	26
Lennonville ...	638	25
Mt Magnet ...	598	26
GASCOYNE—*contd.*		
Warracoothara ...	—	—
Challa*	452	19
Youeragabbie ...	322	9
Murrum	316	17
Yalgoo	425	37
Gabyon	—	—
Gullewa	—	—
SOUTH-WEST DIVISION (NORTHERN PART):		
Murchison House ...	1,379	51
Mt. View*	1,230	60
Yuin	—	—
Northampton ...	1,879	58
Mt. Erin	1,864	64
Oakabella	—	—
Narra Tarra ...	—	—
Tibradden	1,890	60
Sand Springs ...	1,726	58
Mullewa	1,080	43
Kockatea	—	—
Bootenal	1,870	60
Geraldton	1,848	82
Greenough	2,305	68
Dongara	1,875	52
Dongara (Pearse) ...	1,845	64
Strawberry* ...	1,493	43
Minginew	1,984	80
Rothesay	1,049	27
Field's Find* ...	532	32
Carnamah	1,399	55
Watheroo	1,250	66
Dandaragan ...	2,154	80
Moora	1,464	67
Yatheroo	2,388	88
Walebing	1,657	92
New Norcia ...	1,729	88
SOUTH-WESTERN DIVISION, CENTRAL (COASTAL):		
Gingin	3,541	98
Belvoir	2,735	84
Mundaring	3,590	99
Guildford	3,090	105
Kalbyamba* ...	3,191	102
Canning Waterworks	3,738	92
Perth Gardens ...	3,584	118
Perth Observatory...	3,675	122

— Signifies "returns incomplete." * Eleven months only.

RAINFALL FOR THE YEAR—*continued.*

Stations.	No. of points. 100 = 1in.	No. of wet days.
South-Western Division, Central (Coastal)—*contd.*		
Subiaco	3,598	108
Claremont	3,412	108
Claremont (Richardson)*	3,092	82
Fremantle	2,816	123
Rottnest	2,531	117
Armadale	2,971	96
Rockingham ...	2,939	97
Canning River ...	3,773	109
Jarrahdale	4,094	96
Mandurah	3,129	98
Pinjarrah	3,253	95
Harvey	3,415	—
South-West, Central Part (Inland):		
Goomalling	—	—
Momberkine ...	1,271	53
Culham	1,442	73
Newcastle	1,522	65
Eumalga*	1,744	80
Northam	1,168	69
Grass Valley ...	1,304	56
Meckering*	1,276	53
Cunderdin	—	—
Doongin	916	47
Whitehaven ...	—	—
Sunset Hills ..	1,341	72
Cobham	1,408	90
York	1,316	77
Beverley	1,183	65
Barrington	1,260	72
Sunning Hill ...	1,421	58
Wandering	1,757	94
Pingelly	1,031	58
Marradong	2,041	83
Bannister	2,018	100
Narrogin	1,340	82
Wickepin*	1,246	70
South-West Division (Southern Part):		
Bunbury	3,388	114
Collie	3,103	125
Salvation Army Settlement	—	—
Glen Mervyn ...	3,278	108

Stations.	No. of points. 100 = 1in.	No. of wet days.
South-West Division (Southern Part)—*contd.*		
Dardanup	3,149	107
Donnybrook ...	3,455	114
Boyanup	3,561	124
Busselton	3,017	151
Quindalup	—	—
Margaret River ...	4,767	119
Lower Blackwood*...	3,484	110
Karridale	4,950	180
Augusta	4,027	133
Cape Leeuwin ...	3,731	209
Bidellia	3,839	135
The Warren ...	4,483	130
Lake Muir	2,699	151
Mordalup	2,128	152
Deeside	2,679	121
Riverside	2,914	139
Balbarup	3,271	134
Wilgarup	3,047	131
Mandalup	3,149	103
Bridgetown	2,980	136
Greenbushes ...	3,727	110
Williams	1,397	92
Arthur	1,362	97
Darkan*	1,485	70
Wagin	1,362	84
Glencove	1,382	94
Dyliabing	1,319	68
Katanning	1,649	97
Kojonup	1,694	70
Broomehill	1,374	95
Sunnyside	1,495	101
Woodyarrup .	1,552	105
Cranbrook	1,533	82
Blackwattle... ...	1,817	72
Mt. Barker	2,305	115
Kendenup	2,040	114
St. Werburgh's ...	2,361	150
Forest Hill	2,910	167
Denmark	3,853	130
Albany	3,066	151
Point King	3,062	129
Breaksea	2,233	136
Wattle Hill	—	—
Cape Riche	1,603	71
Pallinup	1,356	95
Bremer Bay... ...	2,038	102
Jarramongup ...	1,377	90

— Signifies "returns incomplete." * Eleven months only.

RAINFALL FOR THE YEAR—*continued.*

Stations.	No. of points. 100 = 1in.	No. of wet days.	Stations.	No. of points. 100 = 1in.	No. of wet days.
Eastern Division:			Eastern Division —contd.		
Lake Way*	758	35	Woolgangie ...	—	—
Mt. Sir Samuel ...	655	30	Boorabbin	723	51
Lawlers	748	43	Karalee	676	39
Leinster G.M. ...	—	—	Yellowdine* ...	623	—
Lake Darlôt ...	767	19	Southern Cross ...	738	49
Diorite King* ...	655	31	Mt. Jackson ...	675	39
Sturt Meadows ...	510	—	Bodallin	723	—
Mt. Leonora ...	612	29	Burracoppin ...	679	31
Mt. Malcolm ...	530	18	Kellerberrin ...	919	57
Mt. Morgan	692	28	Mangowine* ...	1,061	—
Burtville	—	—	Wattoning* ...	809	37
Laverton	691	30			
Murrin Murrin ...	553	47	Eucla Division:		
The Granites ...	515	—	Ravensthorpe ...	—	—
Tampa	490	25	Coconarup	1,675	87
Niagara*	594	31	Hopetoun	—	—
Yerilla	630	38	Fanny's Cove ...	2,051	100
Edjudina	—	—	Park Farm	2,061	101
Menzies	717	30	Esperance	2,389	115
Mulline	—	—	Gibson's Soak ...	1,967	73
Wangine	—	—	30-Mile Condenser ...	1,338	62
Waverley	—	—	Swan Lagoon* ...	1,398	118
Goongarrie	686	30	Grass Patch ...	1,295	104
Mulwarrie	—	—	Myrup	—	—
Kurawa	768	41	Lynburn	—	—
Dixie Gold Mine* ...	671	41	Boyatup	—	—
Kurnalpi	763	43	Middle Island ...	—	—
Bulong	998	45	Point Malcolm ...	—	—
Kanowna	653	43	Israelite Bay ...	1,315	70
Kalgoorlie	803	43	Bulbinia	—	—
Coolgardie	718	39	Fraser Range ...	724	35
Burbanks P.O. ...	—	—	Balladonia	759	42
Burbanks Birthday Gift	601	40	Southern Hills ...	—	—
Woolubar*	716	32	Eyre	1,188	—
Widgiemooltha ...	797	48	Madura	—	—
50-Mile Tank ...	817	30	Mundrabillia ...	—	—
Norseman	872	52	Eucla	1,202	69
Bulla Bulling* ...	671	—			

— Signifies "returns incomplete." * Eleven months only.

The Observatory, Perth,
29th January, 1902.

W. E. COOKE,
Government Astronomer.

THE CLIMATE OF WESTERN AUSTRALIA DURING JANUARY, 1902.

The most noticeable feature in the weather maps for this month was the succession of monsoonal storms which passed across the State from the North-West coast to the Great Bight. As it is only during the last few years that we have had any opportunity of investigating these very interesting and most important disturbances, no apology for the following details is necessary. Even now we are sadly hampered by scarcity of observations; but each year, as settlement extends farther Eastwards, our opportunities will increase. The importance of studying their movements will be grasped when it is known that it is upon these storms that the goldfields must depend for their summer supply of rain.

There is a general tendency for the atmospheric pressure to be relatively low in the tropics at this time of the year, but it occasionally happens that the barometer falls a little lower than usual, and a fairly well defined "low" exists off the North-West coast. When this is accompanied by Easterly winds and heavy rain, especially in the extreme North, the conditions are favourable for an overland passage. Such conditions were developing on the 13th and 14th, and on the latter day a tongue of low pressure extended from the North-West coast down towards Southern Cross, and heavy rain commenced to fall in the tropics, extending to latitude 21°, next morning, with a little also inland. By this time, 8 a.m. the 15th, the tongue had crossed the South coast and extended East and West, causing the barometers to fall throughout the Southern portions of the State, and presenting the appearance of a winter "low," except for the valley connecting this with a "low" still off the North-West coast. That it developed in this particular manner is shown by the general appearance of the maps on the 14th and 15th, and by the fact that the wind at Cape Leeuwin steadily backed from East-South-East at midnight, 4 and 8 a.m. of the 14th, through South to West-North-West at next midnight. The "low" and connecting valley now moved Eastward, and the heavy rain came steadily Southward, reaching latitude 24° at 8 a.m. on the 16th, with some showers down to latitude 30°. Next morning moderate to heavy rains were recorded down to latitude 29°. During all this time the barometer remained low off the North-West coast, and the Southern portion eventually broke away during the 16th, and travelled along the Southern ocean like an ordinary winter "low." By the morning of the 18th general heavy rains were recorded throughout the Murchison fields, and next day they just reached the Northern portions of the Coolgardie goldfields. The "low" in the North-West now began to show signs of moving inland, and during the 19th splendid rains fell throughout the Murchison and Coolgardie gold-

fields, and just reached the South coast. On the 20th the "low" was lost somewhere inland but appeared next day to the South of South Australia, and that State experienced an almost phenomenally fierce dust storm on the afternoon of the 21st. On the 22nd it had reached the Sydney coast, and New South Wales had the same unpleasant experience. One point is perhaps worth noting, as it is believed to be of common occurrence, and was noted on two occasions during the passage of this disturbance. When the centre of either the principal or subsidiary "low" reaches the ocean after traversing the continent, the barometers in and near the centre fall lower than when on land, and this fall apparently assists to build up a "high" to the Westward. The converse effect is also noticed as the storm comes in from the tropical ocean, the barometer in the centre of the "low" being apparently much lower over the ocean than after it has reached land and commenced to travel across. Another point is also well worth consideration. It is that, as a general rule, the weather along the coast between about Geraldton and Busselton remains fine throughout the passage of these disturbances. It is also fine in the extreme South-West until the "low" reaches the South coast, when the unsettled weather usually spreads out and just reaches the Leeuwin. In fact, the foregoing description may be taken as typical of this kind of disturbance, as far as our present knowledge goes.

Another "low" appeared off the North-West coast on the 26th, a tongue shot down and gave grand rains throughout the interior during the 27th, and the main storm followed on the 29th, giving a repetition of this very welcome weather. This one passed fairly across the fields and came out to the South-West of South Australia on the morning of the 31st. In its passage, the barometer fell as low as 29·35 at Menzies on the Coolgardie goldfields; an unusual occurrence.

As might be expected after the above notes, the rainfall throughout the State was very heavy, and far in excess of that for previous years except in central West coastal districts, where only a few showers fell.

The temperature throughout the State was remarkably low, in fact, with the exception of Derby and Esperance, the mean maximum day temperature was in every instance considerably below the normal. At Perth it was the lowest recorded since January 1889, and the general impression was that for an Australian summer the weather was delightful.

The Climate of Western Australia during January, 1902.

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					January, 1902.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
NORTH-WEST AND NORTH COAST:															
Wyndham ...	29·742	29·728	29·879	29·568	92·4	79·1	85·8	101·9	73·0	98·0	78·8	113·0	69·0	1067	1067
Derby ...	29·754	29·750	29·863	29·631	95·3	76·3	85·8	100·6	71·5	94·1	77·3	107·0	68·0	827	827
Broome ...	29·732	29·743	29·845	29·571	90·8	78·8	84·8	97·0	73·0	91·7	77·6	102·5	68·0	515	515
Condon ...	29·723	29·758	29·861	29·415	91·6	76·2	83·9	106·0	70·0	94·9	...	106·0	...	1163	1163
Cossack ...	29·772	29·709	29·896	29·438	93·9	76·7	85·3	104·0	72·0	98·2	78·0	119·0	60·0	705	705
Onslow ...	29·712	29·773	29·851	29·549	92·5	75·0	83·8	116·8	64·0	97·8	72·7	121·0	51·0	272	272
Carnarvon ...	29·782	29·789	29·918	29·547	85·2	70·5	77·8	100·2	64·5	90·1	69·8	114·0	58·2	411	411
Hamelin Pool ...	29·780	...	29·972	29·436	94·6	66·6	80·6	104·5	59·0	98·9	69·6	110·2	55·2	112	112
Geraldton ...	29·845	29·890	30·095	29·641	80·1	61·9	71·0	99·8	45·3	84·4	64·1	115·0	50·0	37	37
INLAND:															
Hall's Creek ...	29·766	...	29·946	29·638	97·3	77·0	87·2	107·0	70·4	...	...	...	...	699	699
Marble Bar ...	...	...	...	...	100·3	77·2	88·8	113·5	74·0	...	...	...	...	429	429
Nullagine ...	29·696	...	29·917	29·540	96·4	73·9	85·2	111·0	72·0	...	...	...	...	886	886
Peak Hill ...	29·714	...	29·984	29·497	93·0	71·4	82·2	111·4	63·8	...	...	...	...	1083	1083
Wiluna ...	...	...	...	...	92·1	68·6	80·4	109·6	58·0	...	...	...	...	913	913
Cue ...	29·772	29·793	30·081	29·524	94·8	69·7	82·2	110·5	57·2	102·5	74·2	113·0	55·3	520	520
Yalgoo ...	29·756	29·804	30·088	29·470	94·1	66·0	80·0	107·2	57·0	100·5	70·5	110·5	54·3	225	225
Lawlers ...	29·772	...	30·135	29·459	91·8	69·5	80·6	109·0	54·3	...	...	...	...	515	515
Laverton ...	29·802	...	30·172	29·355	89·6	67·8	78·7	110·2	54·0	...	...	...	...	485	485
Menzies ...	29·784	29·845	30·92	29·352	90·4	67·5	79·0	108·5	51·2	95·8	68·4	113·2	48·0	313	313
Kalgoorlie ...	29·843	29·896	30·237	29·398	88·8	63·5	76·2	107·9	50·0	93·1	64·6	112·4	47·1	198	198
Coolgardie ...	29·818	...	30·223	29·418	88·3	61·2	74·8	108·3	51·0	93·2	62·8	112·2	46·0	122	122
Southern Cross	29·808	29·875	30·191	29·447	91·8	61·5	76·6	109·8	46·0	94·0	62·2	115·0	44·0	105	105
Walebing ...	...	...	...	...	89·4	59·2	74·3	101·0	51·0	...	...	...	...	3	3
Northam ...	...	...	...	...	91·3	59·1	75·2	102·2	45·2	...	...	...	...	*Nil*	*Nil*
York ...	...	29·902	...	...	89·9	57·8	73·8	100·2	45·0	91·7	63·5	115·0	45·0	*Nil*	*Nil*
Guildford ...	...	...	...	...	86·1	57·6	71·8	98·0	47·0	...	...	...	...	1	1

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Climate of Western Australia during January, 1902—*continued.*

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					January, 1902.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan 1.
SOUTH-WEST AND SOUTH COAST:															
Perth Gardens	29·884	29·935	30·254	29·595	83·8	60·5	72·2	96·0	51·8	88·0	62·6	116·7	46·0	4	4
Perth Observatory	29·890	29·939	30·258	29·594	80·3	60·4	70·4	95·3	51·2	85·5	63·8	107·0	51·5	3	3
Fremantle ...	29·882	29·929	30·228	29·585	76·3	63·0	69·6	94·0	52·0	81·8	62·8	108·0	47·0	1	1
Rottnest ...	29·890	29·902	30·239	29·597	74·3	61·7	68·0	89·4	52·0	80·6	62·5	104·5	50·0	2	2
Mandurah ...	...	...	...	...	80·5	57·9	69·2	96·4	43·0	...	...	...	...	4	4
Wandering ...	...	...	...	...	85·2	52·1	68·6	96·0	43·0	...	...	...	...	*Nil*	*Nil*
Collie	...	...	...	...	82·9	50·1	66·5	93·9	37·7	...	...	...	...	2	2
Donnybrook ...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2
Bunbury ...	29·898	29·960	30·300	29·580	79·7	54·6	67·2	90·8	43·0	81·0	58·2	101·0	42·0	*Nil*	*Nil*
Busselton ...	...	...	...	...	79·3	52·1	65·7	91·0	43·0	...	...	...	...	4	4
Bridgetown ...	...	...	...	...	80·9	46·9	63·9	92·0	33·9	...	...	...	...	1	1
Karridale ...	29·926	30·003	30·280	29·624	72·3	55·4	63·8	80·5	44·2	75·9	57·2	98·0	42·3	23	23
Cape Leeuwin	29·910	29·979	30·223	29·541	71·2	60·4	65·8	76·1	53·8	73·2	62·2	91·6	51·0	29	29
Katanning ...	29·882	29·958	30·270	29·468	84·5	52·3	68·4	96·5	42·0	87·9	54·5	111·0	41·0	*Nil*	*Nil*
Albany ...	29·937	30·024	30·298	29·592	70·7	55·0	62·8	80·6	41·8	70·7	58·8	99·0	45·0	43	43
Breaksea ...	29·922	...	30·275	29·494	68·0	58·1	63·0	75·7	50·5	69·3	59·3	86·5	51·5	49	49
Esperance ...	29·892	30·004	30·238	29·454	83·2	59·2	71·2	94·4	48·8	77·3	59·3	117·0	44·5	69	69
Balladonia ...	29·836	...	30·141	29·423	85·0	57·6	71·3	102·0	49·0	...	...	...	...	205	205
Eyre	29·875	...	30·159	29·443	78·0	63·0	70·5	106·5	47·5	...	...	...	...	232	232

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Observatory, Perth,
6th February, 1902.

W. E. COOKE,
Government Astronomer.

RAINFALL for January, 1902 (completed as far as possible), and for December, 1901 (principally from Telegraphic Reports).

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
East Kimberley:				
Wyndham ...	247	...	1067	17
6-Mile	188	6	1648	17
The Stud Station	...	...	...	...
Carlton	99	9	...	...
Denham	...	...	...	...
Rosewood Downs	...	...	...	...
Argyle Downs ...	...	...	...	...
Lisadell	...	...	...	...
Turkey Creek ...	226	12	850	13
Plympton, St. Mary	60	...	...	...
Koojubrin ...	...	...	...	...
Hall's Creek ...	118	...	699	12
Flora Valley ...	...	...	...	...
Ruby Creek ...	...	...	...	...
Ruby Plains ...	...	...	...	...
Denison Downs...	34	...	...	...
West Kimberley:				
Obagama ...	179	7	...	...
Derby	217	6	827	12
Yeeda	...	...	...	...
Liveringa ...	...	...	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs...	...	...	...	...
Fitzroy Crossing	25	2	764	16
Fitzroy (C. Blythe)	...	...	...	...
Quanbun ...	...	...	...	...
Nookanbah ...	...	...	...	...
Broome	200	5	515	...
Roebuck Downs	...	...	..	...
Thangoo	...	...	...	...
La Grange Bay...	2	1	912	17
North-West:				
Wallal ...	6	1	1138	10
Condon	5	1	1163	...
De Grey River ...	Nil	...	...	...
Port Hedland ...	21	1	936	17
Boodarie ...	Nil	...	...	...
Yule River ...	...	...	...	...
Warralong ...	27	2	...	...
Muccan	...	...	...	...
Ettrick	26	1	...	...
Mulgie	86	1	...	...
Eel Creek ...	...	...	...	...
Pilbarra	...	...	995	9
Coongon	15	1	...	...
North-West—*cont.*				
Warrawagine ...	...	...	...	...
Braeside... ...	...	...	...	...
Bamboo Creek ...	28	1	865	13
Marble Bar ...	139	4	429	14
Warrawoona ...	118	5	686	16
Corunna Downs...	19	2	...	...
Nullagine ...	119	5	886	...
Yandicoogina ...	...	...	...	...
Tambourah ...	...	...	...	...
Kerdiadary ...	...	...	...	...
Roy Hill... ...	105	3	...	...
Mosquito Creek	...	...	...	...
Mulga Downs ...	...	...	...	...
Woodstock ...	...	...	...	...
Mt. Florence ...	...	...	...	...
Tambrey ...	...	...	...	...
Millstream ...	12	1	...	...
Yandyarra ...	45	2	...	...
Mallina	Nil	...	...	...
Whim Creek ...	Nil	...	1016	14
Cooyapooya ...	...	...	...	...
Woodbrooke ...	Nil	...	...	...
Croydon ...	43	2	...	...
Balla Balla ...	Nil	...	829	12
Roebourne ...	Nil	...	532	11
Cossack	Nil	...	705	10
Fortescue ...	Nil	...	445	11
Mardie	Nil	...	...	...
Mt. Stewart ...	...	...	...	...
Yarraloola ...	...	...	...	...
Chinginarra ...	Nil	...	...	...
Onslow	9	1	272	10
Peedamullah ...	Nil	...	...	...
Red Hill	15	1	...	...
Mt. Mortimer ...	...	...	...	...
Wogoola ...	...	...	...	...
Nanutarra ...	Nil	...	...	...
Yanrey	Nil	...	...	...
Point Cloates ...	...	...	387	...
Gascoyne:				
Winning Pool ...	Nil	...	535	8
Towara	12	1	...	...
Ullawarra ...	20	1	...	...
Maroonah ...	...	...	...	...
Thomas Police Station	...	...	...	...

RAINFALL—*continued.*

Stations.	December.		January.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
GASCOYNE—*contd.*				
Bangemall ...	...	...	...	...
Mt. Augustus ...	Nil	...	...	...
Minnie Creek ...	...	...	...	...
Yanyeareddy ...	Nil	...	2[illegible]0*	...
Williambury ...	Nil	...	130*	...
Wandagee ...	...	...	361*	...
Bernier Island ...	..	...	...	...
Boolathana ...	...	...	...	...
Carnarvon ...	Nil	...	411	...
Cooralya	...	...	379*	...
Doorawarrah ...	...	...	...	...
Mungarra ...	Nil	...	725*	...
Clifton Downs ...	Nil	...	600*	...
Dairy Creek ...	...	...	...	...
Mt. Clere ...	...	...	...	...
Errivilla	Nil	...	...	...
Dirk Hartog Island	...	...	...	...
Sharks Bay ...	4	1	22	2
Kararang ...	...	...	...	...
Meedo	...	...	...	...
Tamala	10	1	...	...
Wooramel ...	4	1	505	4
Hamelin Pool ...	4	1	112	2
Byro	Nil	...	...	...
Yarra Yarra ...	...	...	...	...
Berringarra ...	Nil	...	1050*	..
Mt. Gould ...	4	2	...	...
Moorarie	...	..	...	...
Peak Hill ...	17	1	1083	14
Horseshoe ...	13	4	...	..
Abbotts'	5	2	799	13
Belele	...	...	...	...
Mileura	Nil	..	1000*	...
Milly Milly ...	...	...	840*	...
Manfred	Nil	...	840*	...
Meelya	Nil	...	...	...
Woogorong ...	Nil	...	...	...
Boolardy	...	...	600*	...
Billabalong ...	...	...	...	...
Wooleane ...	Nil	...	...	...
Murgoo	Nil	...	280	7
Meeka	Nil	...	...	...
Mt. Wittenoom ...	Nil	...	...	...
Nannine	Nil	...	838	12
Star of the East...	Nil	...	802	8
Annean	8	1	691	10
GASCOYNE—*contd.*				
Tuckanarra ...	Nil	...	642	9
Coodardy ...	...	...	493	7
Cue	9	1	520	10
Day Dawn ...	Nil	...	502	7
Lake Austin ...	Nil	...	441	9
Lennonville ...	5	1	291	4
Mt. Magnet ...	Nil	...	284	5
Warracoothara ...	...	...	...	...
Challa	Nil	...	260	3
Youeragabbie ...	Nil	...	...	...
Murrum	Nil	...	309	5
Yalgoo	3	2	225	6
Gabyon	...	...	...	...
Gullewa	16	2	26	...
SOUTH-WEST DIVISION (NORTHERN PART):				
Murchison House	7	2	...	...
Mt. View ...	...	...	...	...
Yuin	...	...	...	...
Northampton ...	13	1	Nil	...
Mt. Erin ...	17	1	...	...
Oakabella ...	...	...	...	...
Narra Tarra ...	...	...	...	...
Tibradden ...	12	1	...	...
Sand Springs ...	Nil	..	80	1
Mullewa... ...	5	1	55	2
Kockatea ...	12	2	11	2
Bootenal ...	Nil	...	33	2
Geraldton ...	Nil	...	37	3
Greenough ...	4	1	Nil	...
Dongara ...	Nil	...	Nil	...
Dongara (Fearse)	13	1	...	...
Strawberry ...	...	...	...	...
Mingenew ...	20	2	Nil	...
Rothesay ...	16	1	17	2
Field's Find ...	...	...	...	...
Carnamah ...	5	1	84	1
Watheroo ...	20	1	Nil	...
Dandaragan ...	48	3	Nil	...
Moora	11	2	Nil	...
Yatheroo ...	38	4	Nil	...
Walebing ...	41	5	3	1
New Norcia ...	25	2	Nil	...

* Probably part of month only.

RAINFALL—*continued.*

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
South-Western Division, Central (Coastal):				
Gingin	66	5	Nil	...
Belvoir	33	2	3	2
Mundaring ...	92	4	3	1
Guildford ...	45	6	1	1
Kalbyamba ...	...	...	...	...
Canning W't'r'w'ks	68	5	Nil	...
Perth Gardens ...	58	7	4	2
Perth Observatory	52	7	3	2
Subiaco	35	6	Nil	...
Claremont ...	61	7	2	1
Claremont (Richardson)	...	...	...	...
Fremantle ...	51	6	1	1
Rottnest	29	6	2	1
Armadale ...	48	6	8	1
Rockingham ...	76	6	10	1
Canning River ...	61	4	4	1
Jarrahdale ...	164	5	8	1
Mandurah ...	92	5	4	1
Pinjarra	54	4	3	1
Harvey	142	8	...	...
South-West, Central Part (Inland):				
Hatherley ...	...	...	Nil	...
Momberkine ...	13	2	Nil	...
Culham	28	3	2	1
Newcastle ...	20	2	Nil	...
Eumalga ...	...	...	Nil	...
Northam ...	5	1	Nil	...
Grass Valley ...	17	1	...	...
Meckering ...	...	...	...	...
Cunderdin ...	...	...	...	...
Doongin	13	2	...	...
Whitehaven ...	...	...	...	...
Sunset Hills ...	34	4	Nil	...
Cobham	28	5	Nil	...
York	30	5	Nil	...
Beverley ...	6	2	Nil	...
Barrington ...	15	4	...	...
Sunning Hill ...	15	3	...	...
Wandering ...	17	5	Nil	...
Pingelly ...	Nil	...	Nil	...
Marradong ...	34	3	Nil	...

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
South-West—*contd.*				
Bannister ...	27	4	Nil	...
Narrogin ...	42	6	Nil	...
Wickepin ...	28	4	...	...
South-West Division (Southern Part):				
Bunbury ...	88	5	Nil	...
Collie	105	7	2	1
Salvation Army Settlement	...	...	...	...
Glen Mervyn ...	192	7	...	...
Dardanup ...	93	6	Nil	...
Donnybrook ...	137	9	2	1
Boyanup ...	68	7	3	1
Busselton ...	74	8	4	4
Quindalup ...	...	...	...	...
Margaret River	281	9	1	1
Lower Blackwood	...	...	15	1
Karridale ...	502	12	23	8
Augusta ...	488	11	44	9
Cape Leeuwin ...	375	14	29	10
Biddellia ...	145	10	35	6
The Warren ...	292	9	37	4
Lake Muir ...	145	8	...	...
Mordalup ...	143	10	...	...
Deeside	119	9	10	2
Riverside ...	106	7	34	8
Balbarup ...	167	11	21	5
Wilgarup ...	129	9	...	...
Mandalup ...	183	4	...	...
Bridgetown ...	114	10	1	1
Greenbushes ...	251	9	7	1
Williams ...	35	6	1	1
Arthur	34	6	4	2
Darkan	77	2	...	...
Wagin	74	6	2	1
Glencove ...	50	6	...	...
Dyliabing ...	40	2	Nil	...
Katanning ...	63	7	Nil	...
Kojonup ...	68	4	1	1
Broomehill ...	64	6	5	1
Sunnyside ...	56	6	6	1
Woodyarrup ...	83	7	...	...
Cranbrook ...	105	4	Nil	...
Blackwattle ...	164	3	...	...
Mt. Barker ...	238	6	30	5
Kendenup ...	147	5	11	1

RAINFALL—*continued.*

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
SOUTH-WEST— *contd.*				
St. Werburgh's	264	9	...	...
Forest Hill ...	296	9	...	...
Denmark ...	273	7	...	...
Albany	459	11	43	8
Point King ...	324	8	59	5
Breaksea ...	319	10	49	9
Wattle Hill ...	...	...	...	...
Cape Riche ...	182	6	...	...
Pallinup ...	84	6	...	...
Bremer Bay ...	81	10	8	1
Jarramongup ...	117	5	...	...
EASTERN DIVISION:				
Lake Way ...	9	3	913	12
Mt. Sir Samuel ...	14	2	582	12
Lawlers	9	2	515	9
Leinster G.M. ...	...	...	...	...
Lake Darlôt ...	28	1	...	...
Diorite King ...	8	...	...	...
Sturt Meadows...	...	...	...	...
Mt. Leonora ...	8	2	340	11
Mt. Malcolm ...	1	1	341	6
Mt. Morgans ...	32	3	306	8
Burtville ...	78	1	370	8
Laverton ...	54	3	485	10
Murrin Murrin...	15	5	368	9
The Granites ..	34	3	350	8
Tampa	11	2	...	...
Niagara	28	2	467	5
Yerilla	14	2	...	...
Edjudina ...	...	...	286	3
Menzies	22	2	313	5
Mulline	...	...	...	...
Wangine ...	...	...	...	...
Waverley ...	38	2	168	4
Goongarrie ...	20	2	381	4
Mulwarrie ...	36	1	161	4
Kurawa	12	2	241	3
Dixie Gold Mine	22	3	194	3
Kurnalpi ...	3	1	431	4
Bulong	9	2	253	3
Kanowna ...	5	1	259	4
Kalgoorlie ...	22	3	198	5
Coolgardie ...	22	2	125	7
Burbanks P.O. ...	19	2	131	5

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
EASTERN—*contd.*				
Burbanks Birthday Gift	20	3	114	5
Woolubar ...	Nil	...	...	...
Widgiemooltha...	36	2	142	4
50-Mile Tank ...	18	2	72	2
Norseman ...	17	2	74	4
Bulla Bulling ...	17	1	116	3
Woolgangie ...	40	...	45	3
Boorabbin ...	16	1	70	4
Karalee	Nil	...	...	...
Yellowdine ...	Nil	...	97	2
Southern Cross...	3	1	105	3
Mt. Jackson ...	14	1	60	4
Bodallin ...	23	4	129	3
Burracoppin ...	Nil	...	11	2
Kellerberrin ...	14	2	Nil	...
Mangowine ...	Nil	...	39	2
Wattoning ...	...	...	...	...
EUCLA DIVISION:				
Ravensthorpe ...	104	9	25	4
Coconarup ...	94	7	...	...
Hopetoun ...	141	8	51	6
Fanny's Cove ...	28	4	...	...
Park Farm ...	78	6	...	...
Esperance ...	48	6	69	...
Gibson's Soak ...	53	3	108	2
30-Mile Condenser	62	3	...	...
Swan Lagoon ...	...	...	...	...
Grass Patch ...	61	10	...	...
Myrup	60	6	...	...
Lynburn ...	...	...	...	...
Boyatup... ...	14	2	...	...
Middle Island ...	...	...	...	...
Point Malcolm ...	45	5	140	8
Israelite Bay ...	48	3	115	4
Bulbinia ...	...	...	...	...
Frazer Range ...	37	3	...	...
Balladonia ...	25	4	205	...
Southern Hills ...	26	2	...	...
Eyre	8	4	232	9
Madura	10	3	...	...
Mundrabillia ...	70	4	...	...
Eucla	85	4	115	9

The Observatory, Perth,
5th February, 1902.

W. E. COOKE,
Government Astronomer.

Return of Fruit imported into Western Australia during January, 1902.

Name of Port.	Total No. of Cases.	No. of Cases Passed.	No. of Cases Prohibited.	No. of Cases Destroyed.	No. of Cases of														
					Apples.	Apricots.	Bananas.	Cherries.	Gooseberries.	Lemons.	Peaches.	Oranges.	Passion Fruit.	Pears.	Plums.	Rhubarb.	Pomoloes.	Pines.	All other fruits.
Fremantle ...	7382	6721	661	661	62	...	581	564	84	1641	10	816	...	...	2839	11	...	110	3
Albany	359	318	11	11	67	12	...	...	...	53	9	...	2	45	150	...	...	10	...
Geraldton ...	9	9	...	...	...	...	7	...	...	...	...	...	...	...	...	...	...	...	2
Hamelin	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	7750	7078	672	672	129	12	588	564	84	1694	19	816	2	45	2989	11	...	120	5

Department of Agriculture,

4th February, 1902.

Return of Fruit Trees and Plants imported into Western Australia during January, 1902.

Name of Port.	No. of Consignments of Trees or Plants.	Total No. of Trees or Plants in such Consignments.	No. of Consignments passed.	Total No. of Trees or Plants in such Consignments.	No. of Consignments of Trees or Plants prohibited.	Total No. of Trees or Plants in such Consignments.	No. of Trees.															
							Ornamental and Pot Plants.	Almonds.	Apples.	Apricots.	Cherries.	Figs.	Lemons.	Limes.	Mulberries.	Oranges.	Peaches.	Pears.	Plums.	Small Fruits.	Vine Cuttings.	All other Trees.
Fremantle ...	8	1556	8	1556	...	...	1556	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Albany ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Geraldton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...
Bunbury ...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...
Total ...	8	1556	8	1556	...	...	1556	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Department of Agriculture,
4th February, 1902.

By Authority: Wm. Alfred Watson, Government Printer, Perth.

JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA.

Vol. 5.—Part 3.

MARCH, 1902.

PERTH:
BY AUTHORITY: WM. ALFRED WATSON, GOVERNMENT PRINTER.
1902.

NOTES.

THE HEALING OF WOUNDS.—Wounds may heal so long as the sap is circulating, but most readily during the late spring and early autumn. Cold and wet, as well as great heat and drought, act against the movement of the sap, and in its absence the bark on the sides of wounds is liable to be killed. Keep wounds clean and smooth if you would have them heal over. Apply no mineral poisons, such as red or white lead, or ordinary wood paint. Vegetable oils, lard, or other animal fat, or grafting wax, will serve to keep out damp and disease germs, toadstools, insects, and extremes of heat and cold; so that any sap brought to the margin of wounds will remain alive to formulate new bark.

SEPARATED MILK AS PIG FOOD.—In a brief article on the above subject the *Farmers' Gazette* remarks:—"Professor Henry says that when a pound of maize meal is employed with from one to three pounds of separated milk, 327lbs. of the milk saves 100lbs. of meal, or in other words, by the employment of the mixture in the proportion suggested, 1lb. of maize meal becomes equal to 3¼lbs. of the milk. As the quantity of the milk is increased per lb. of maize meal, so is its value diminished; for instance, when the quantity of milk was increased from 3 to 5lbs. per pound of maize Professor Henry found the one pound of meal was worth 4½lbs. of milk. When 2lbs. more milk was added, then 1lb. of meal became equal to 5¾lbs. of milk, and again adding another 2lbs. the difference was but slight. What Henry has found in the United States, Fjord found in another direction in Denmark, although unhappily Fjord's work has closed, for he is no longer in the land of the living. The result of his experimental feeding was that 1lb. of grain, not maize in this particular case, alone was equal to 6lbs. of the milk, but it is believed that the average quantity of the milk employed by Fjord was larger than the quantity of milk employed by Henry. In Henry's investigations, taking the average of the whole series, 1lb. of meal was worth 4¾lbs. of milk, so that after all the difference was not amazing. If we take maize as worth £4 a ton, and we fix this figure for the purpose of argument, as well as for convenience in calculation, the American feeder finds that the separator milk is worth 15d. per ten gallons, or, practically speaking, the same price as that which is usually fixed by the English feeder, 1½d. a gallon. This, however, is only the case when each pound of maize meal is mixed with no more than 3lbs. of the milk, but as the quantity of milk is increased per pound of maize the value of the milk per gallon is reduced. Dealing, for example, with the whole of the series of experiments conducted by Henry, *i.e.*, from the first in which from 1 to 3lbs. of milk were employed, to the last in which 7 to 9lbs. of milk were employed, we got an average price of 11d. per 100lbs., or a fraction more than a penny a gallon. Now these figures are of prime importance; every pig feeder who is able to use milk should study them with close attention, for it is evident that where maize costs a large sum, as, for example, £5 a ton, to

say nothing of barley meal, it becomes infinitely economical to use it in conjunction with milk. At this price the milk would be worth 1s. 6d. per 100lbs., or nearly 2d. a gallon."

THE IMPORTANCE OF BARK.—Beyond acting as a support, wood is not actually necessary to the life of bark and leaves. Any cylinder of bark from which the wood has been skilfully removed will, if its sides are carefully closed against air, go on growing and deposit new layers in its inside until a centre of solid new wood is formed. This applies only to exogenous trees, or such as increase their diameter by depositing new layers on their exterior. Such are all our fruit trees, and when it is realised that the entire life of the superstructure is wrapped up in the bark, the need for careful and systematic attention to this substance is not to be over-estimated.—*Victorian Agricultural Journal.*

LAYING COMPETITION.—The fifth laying competition under the Utility Poultry Club's auspices is being conducted under the superintendence of Mr. Simon Hunter, at Northallerton, York, England. Progress is appended. Each pen consists of four pullets hatched in 1901. The points are reckoned thus: An egg weighing up to $1\frac{3}{4}$oz. counts 1; above that, 2.

From October 16th.	4 Weeks. Nov. 12th.		8 Weeks. Dec. 10th.		12 Weeks. Jan. 7th, '02.	
Pen.	Eggs.	Points.	Eggs.	Points.	Eggs.	Points.
1. Buff Orpingtons	17	34	35	70	63	126
2. White Leghorns	0	0	17	34	67	134
3. Buff Orpingtons	20	40	27	54	55	110
4. White Leghorns	13	26	57	113	74	146
5. Buff Orpingtons	24	48	78	156	122	244
6. White Leghorns	24	42	89	172	139	270
7. Silver Wyandottes	20	38	35	68	76	148
8. Minorcas	11	22	44	86	53	104
9. Golden Wyandottes	65	130	109	217	145	287
10. Minorcas	0	0	1	2	1	2
11. White Wyandottes	20	36	33	62	48	90
12. Buff Leghorns	4	8	19	37	62	121
13. Barred Rocks	0	0	16	31	39	77
14. Anconas	0	0	3	6	19	36
15. Buff Rocks	28	56	33	65	67	133
16. Anconas	30	60	82	160	100	195
17. Black Rocks	3	6	19	36	31	60
18. Anconas	0	0	18	36	46	90
19. Faverolles	0	0	3	6	20	40
20. White Leghorns	40	80	84	168	121	242
	319		802		1,348	

—*Farmer and Stockbreeder.*

DO POULTRY SPREAD DIPHTHERIA?—Do poultry spread diphtheria? is a question which has been raised in one of the provincial papers, says the *Sanitary Record.* The possibility of infection from this source, when the filthy conditions under which fowls are often kept are considered, is by no means remote. As every poultry-keeper knows, fowls are peculiarly subject to a disease which is analogous to diphtheria in man, known as

diphtheritic croup or "canker." This is produced by filthy surroundings, and is so infectious that once it gets thoroughly hold of a pen of birds, it kills them off in scores, and there is the utmost difficulty in stamping it out. Children, as we know, are particularly fond of playing in the vicinity of poultry runs, and it is to be feared that poultry-keepers are not as careful as they might be in isolating birds that are sick. It has been suggested that fowl-runs should be placed under sanitary control, and that when disease breaks out the authorities should be notified; but the necessity for going as far as this might, we think, be obviated if the poultry papers would only impress upon their readers the necessity for observing better sanitary conditions and isolation in all cases of sickness.

Medical Value of Honey.—Honey has more value as a medicinal agent than most people credit it with. It is composed chiefly of sugar and water, but also contains volatile oils derived from the flowers, also gum and wax. Many children who will not take medicine except under great pressure will willingly eat honey, which acts when taken alone as a laxative. A gargle composed of honey and water is good for sore throat. It is also often used to disguise the taste of other medicines which are not pleasant.

Bird Pests.—A deputation to the Minister for Lands, who were introduced by Mr. Hayward, M.L.A., pointed out that the bird known as the "silver eye" was becoming a great pest, having caused a considerable amount of injury to orchardists and fruit growers in the Bunbury district. They mentioned that at a recent meeting in the southern town to consider the matter, it was resolved to approach the Minister and ask him to send an officer down to the district to inquire into the habitat of the bird, and also to ask the Government to provide a sum of money for the payment of bonuses for the killing of the bird. Mr. Gell, a member of the deputation, pointed out that great havoc was also being caused in many districts of the State by a special variety of parrot, and he suggested that the bonuses to be paid should be for the destruction of both kinds of pests. Dr. Jameson, in reply, promised to consider the matter, and see what could be done.—*West Australian.*

Producers' Co-operative Association.—A meeting of producers was held yesterday afternoon in the Museum of the Department of Agriculture, with the object of taking the initial steps in forming a co-operative association. About twenty representatives of the farming and fruit-growing industries assembled, and Mr. S. Solomon was voted to the chair. A resolution stating, "That in the opinion of this meeting the time has arrived when a Co-operative Association of Producers should be formed," was proposed by Mr. Jacoby, M.L.A., and seconded by Mr. J. M. Whistler. The motion having been debated thoroughly, it was agreed to. The meeting then decided to elect a committee to draft a scheme for carrying out the purpose of the resolution. The gentlemen elected were the chairman, and Messrs. Harper, Jacoby, E. M. Clarke, and Palmatur, and the scheme when drawn up will be submitted to the Producers' Associations of the State.—*West Australian.*

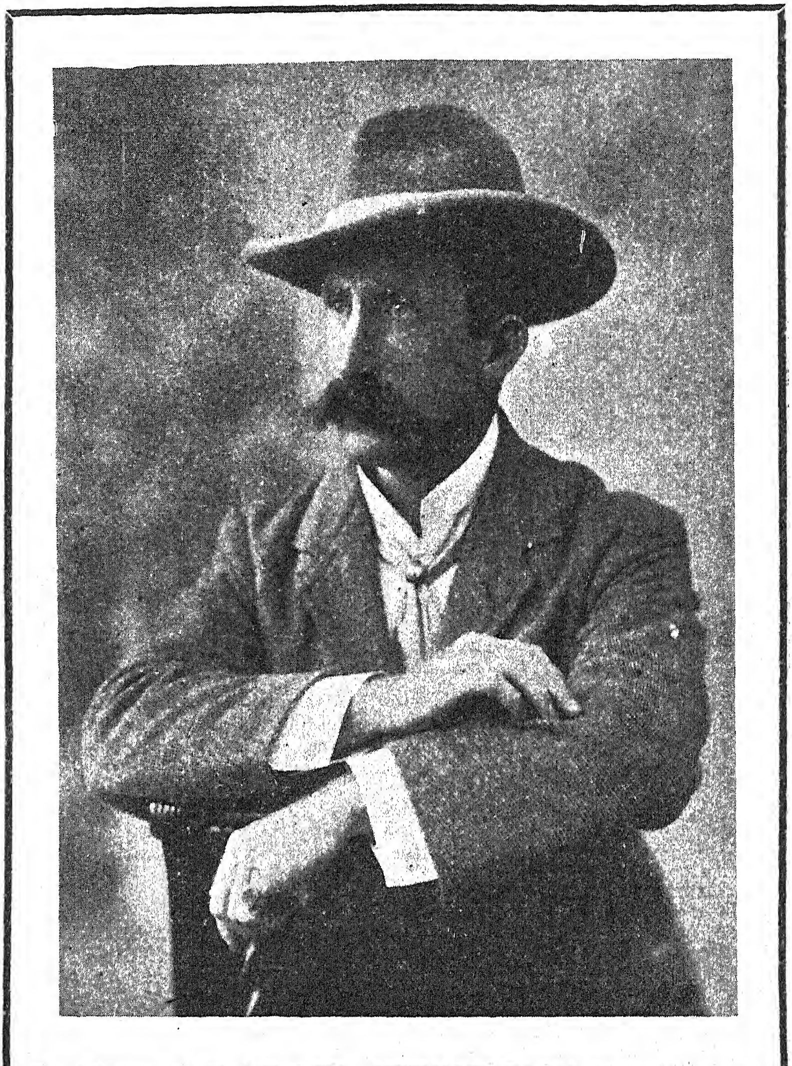
DEATH OF MR. LINDLEY-COWEN.

A BRIEF ILLNESS.

(From the *Western Mail.*)

It is with much regret that we record the death of Mr. Lancelot Lindley-Cowen, Secretary of the Department of Agriculture, which took place at an early hour on Wednesday morning, the 19th February. The news of his death came as a great surprise to his many friends in Perth and Guildford, as, although he had been known to be in indifferent health lately, and, a few days ago, had been obliged to absent himself from his duties, it was not expected that his illness would have a fatal termination. On the Friday preceding he became so unwell that medical aid was called in. On Monday evening his physician, Dr. J. M. Y. Stewart, ordered his removal to the Guildford Hospital, and on Tuesday morning it became necessary to perform an operation, which was undertaken by Dr. J. M. Y. Stewart, Dr. F. Stewart, and Dr. Burkitt. After the operation a slight improvement was noticeable in the condition of the patient, but in the night he developed symptoms of such an alarming nature as to leave little hope of his recovery. Mr. Cowen's condition gradually weakened, and, at half-past 3 o'clock on Wednesday morning he died, leaving behind him a widow and daughter, for whom the profoundest sympathy has been everywhere expressed in their painfully sudden bereavement.

Mr. Cowen was in the prime of life, having attained the age of 44 years. Prior to his arrival in Western Australia, he had travelled considerably. A Virginian by birth, he entered the United States Navy, in which he attained the rank of lieutenant, and during that time served on the "Enterprise" on the China Station. Eventually he resigned his position in the navy, and, after travelling over America, and also in Europe, he came to Australia. In Victoria, he engaged in newspaper enterprise, and for some time conducted the *Mooroopna Yeoman*, subsequently being engaged in writing on agricultural matters—in which he took a large interest—for the Melbourne *Leader*. He also travelled in the different Australian States, and was a contributor, chiefly upon agronomic subjects, to several of the leading journals there. Arriving in Western Australia during 1889, he held the position of Manager of the Palinup Station, some distance from Broome Hill, and eventually became connected with the West Australian Land Company, in whose interests he conducted, for some time, a newspaper known as the *Albany Observer*. After Mr. Cowen relinquished his interests in Albany, he accepted the position offered to him by the proprietors of the *West Australian*, as travelling commissioner for that journal in the interests of the vine and fruit-growing industry, and also of agriculture generally. At the time—the early nineties, the possibilities of the vine and fruit-growing industry in Western Australia were becoming more apparent, and the conductors of the *West*



L. Lindley-Cowen,

Late Secretary Department of Agriculture, Western Australia.

Australian decided to give the movement every encouragement possible. Mr. Cowen travelled throughout the South-Western part of the State delivering lectures on the industry, and forming vine and fruit-growers' associations, besides contributing series of articles on the same subject, and also on dairying and kindred industries, to the columns of this journal. Upon all these matters he both spoke and wrote fluently, and with an evident large acquaintance with his subject, and there can be no doubt that much of the impetus which the cultivation of the soil in its different branches has received during the past 10 years has been largely due to his efforts. In scanty periods of leisure he was able to obtain, Mr. Cowen found employment for his pen in the paths of humorous literature, and the contributions to this journal which appeared under the *nom de plume* of "Fare Fac," in which the characteristics of American humor were very noticeable, will be remembered by many. When the Agricultural Bureau was formed Mr. Cowen was appointed its secretary. The position which agriculture held amongst the industries of the State was recognised as demanding the establishment of a department directly charged with conserving and promoting its interests, and in Mr. Cowen was found one eminently well fitted to discharge the onerous duties of its secretary. Into the task which lay before him the gentleman threw himself with all the energy at his command, and placed his knowledge, theoretical and practical, at the disposal of the country. Agricultural and horticultural societies were encouraged by the Bureau. Information on all subjects of interest to the tillers of the soil was available. Dairying, stock-breeding, bee-keeping, poultry farming, wine-growing, fruit preserving, besides agriculture, horticulture, and viticulture generally, received the attention of the Bureau, or, as it afterwards came to be known, when placed under direct Ministerial control, the Department of Agriculture. For the encouragement of the producers annual conferences were established, and more recently the annual show of products. Large and commodious offices in the "West Australian" Chambers were secured, and there the Department was housed, and an important museum established, filled with collections representative of the different industries connected with the cultivation of the soil, and a library stocked with the most up-to-date literature on the subject. Legislation dealing with various insect pests and noxious weeds was promoted, and steady and persistent work was carried on under the different Acts, not only to eradicate such pests as existed, but to prevent others, including the much dreaded codlin moth, from obtaining a foothold. Experts were engaged to travel the State, and to lecture and generally instruct the community in all departments of the cultivation of the soil. Hand-books relating to the same subjects, and a monthly publication, the well-known *Journal of the Department of Agriculture*, were issued. All these works were carried out under the direct supervision of Mr. Cowen, and the care and attention, coupled with the trained intelligence he brought to bear upon them, materially assisted the different industries fostered by the Depart-

ment. The Government Refrigerating Works and the Perth City Markets were brought under the Department of Agriculture about two years ago, and the measure of their usefulness since controlled by Mr. Cowen has greatly increased.

Mr. Cowen was not content, however, merely to write and speak on such subjects. He embarked in agricultural and viticultural pursuits for himself, and was one of the proprietors of the Santa Rosa Vineyard, near Guildford, where he lived. That the industries he devoted himself to with so much energy and ability have lost a great friend by his death is only too evident. Essentially a man of action, he laboured for the promotion of their interests with such thoroughness of purpose that though he saw his reward in the position they now hold, yet they are the poorer by the death of Lindley-Cowen.

The funeral of the late Mr. L. Lindley-Cowen took place late on the evening of the day of his death at the Guildford Cemetery. Among those who followed in the procession, which included very many of the residents of Guildford and the surrounding neighbourhood, were Mr. H. J. Saunders, M.L.C., Mr. J. L. Nanson, M.L.A., Mr. R. C. Clifton (Under Secretary for Lands), Mr. F. Brockman, the staff of the Department of Agriculture, including Dr. Morrison, Messrs. Crawford, Wicken, Hooper, and Baker; Dr. J. M. Stewart, Dr. F. Stewart, Mr. H. Gull, Mr. A. Gull, Mr. B. Harper, Mr. F. Craig, and Mr. J. A. Northmore. The service was conducted by the Rev. W. E. Everingham, the rector of the parish. Mr. A. Despeissis, the horticultural and viticultural expert of the Department of Agriculture, was unavoidably absent in the country on business connected with the Department, and, there being no means of communication with him, it was impossible to apprise him of Mr. Cowen's death.

At the opening of the second National Show in Perth on Thursday, 6th March, His Excellency the Governor, Sir Arthur Lawley, K.C.M.G., in referring to Mr. Cowen, said:—"He could not refrain from expressing to the Department, and to the State in general, his very sincere condolences and regret in connection with the very sudden and sad death of their secretary, Mr. Lindley-Cowen. Mr. Cowen had been an active, intelligent, and devoted officer, and a true friend. Their hearts, he felt sure, went out to the widow and little child whom he had left to face the world. He hoped that the Department might be fortunate in securing a successor to carry on the work of advancing the welfare of the agricultural industry of the State as Mr. Cowen had begun it. He had much pleasure in declaring the show open."

TWO VALUABLE GRAPES.

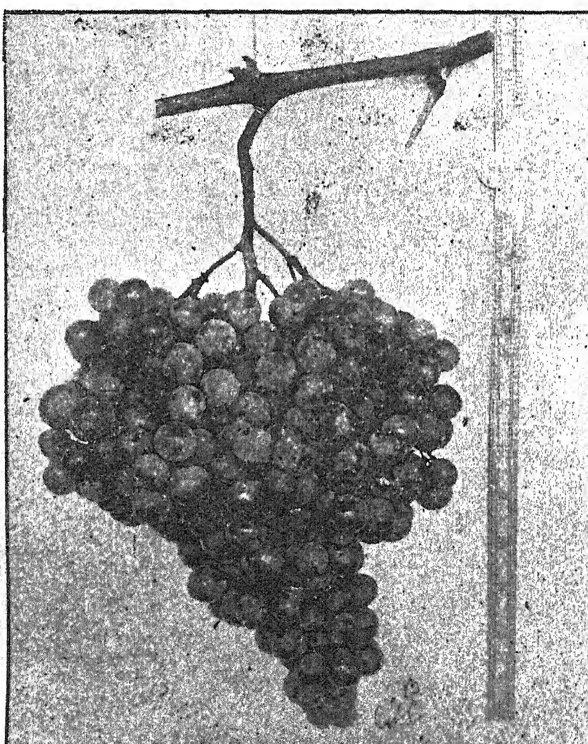
A. Despeissis.

HANEPOOT.

The illustration published in this issue represents a bunch of Hanepoot grape, well known in the Cape of Good Hope vineyards. The photograph is from a bunch grown near Guildford. According to Count Odart, an authority on vines, the variety appears to have been introduced from Persia. It is much valued about Constantia for producing a late eating grape and a sweet wine.

The vine is a vigorous grower, wood light cinnamon colour, leaf large on long leaf stalk, light green in colour, slightly downy underneath; sinus deep and close, bunch large, conical, heavily shouldered, theshoulders hanging from long stalks; berries round, medium to large, well set, pedicels long; white tough skin. This grape ripens beginning of March, and hangs well.

At the Cape Colony indifferent success has at times met the efforts of growers when grafting Hanepoot on *Rupestris* stock whilst most satisfactory results are obtained when *Jacquez* or *Riparia* stocks are used.



Hanepoot Grape.

DOLCETTO.

The illustration given in this issue is from grapes grown by Mr. Giumelli, at the Waterloo Plains, a few miles from Bunbury.

Dolcetto Grape.

The grape commands itself, on account of some of its chief characteristics, to the attention of wine-makers on the moist flats and valley soils of the South-West. It is one of the most widely cultivated grapes of the higher valleys of the Piedmontese Alps of Northern Italy, notably at Alba and Aqui, and is used both as a table-grape and for the making of a good commercial red wine.

Synonymous: *Uva d'Acqui, Dolutz nero.* Vine: vigorous grower and very fruitful. Wood: filbert colour, short jointed. Buds: large and whitish before bursting. Terminal shoots: the young leaves are red and covered with a light whitish down. Leaves: medium size to large, broader than long, smooth and almost glossy above, very slightly woolly below; three or five lobes; sinus, round and deep; teeth, pointed; tendrils, leaf stalk, and ribs reddish. Bunches: medium size to large pyramidal, long, winged, well set with a long, brown stalk. Berries: medium size, almost round, bluish-black, covered with bloom, thin skinned, juicy and sweet. Often fall off readily when very ripe.

This grape ripens early, bears heavily, and makes a light wine, smooth to the palate and quick in maturing. That wine is superior to the produce of the Mataro grape grown alongside on the Waterloo Plains. For blending with our heavier wines it should prove of great value. The vine seems exceedingly well adapted to the local natural conditions obtaining on the moist plains of the South-West districts of Western Australia. It requires long pruning.

ORANGE THRIPS.

A. Despeissis.

The specimens here illustrated are from the Murray, where, during the latter part of the dry summer, this pest has made considerable headway.

The orange thrips, which is the cause of the damage, is similar in size and in colour to the onion thrips or to the garden thrips.

They possess four long, narrow wings, fringed with hairs; the mouth parts are made for sucking as well as for biting, and the toes are bladder-like at tips.

They attack both leaves and fruit, tearing the outward covering of the skin and feeding on the oil cells. This gives to the fruit a grey, russetty appearance, toughening and hardening the rind, thus checking the development of the fruit. When these insects occur in

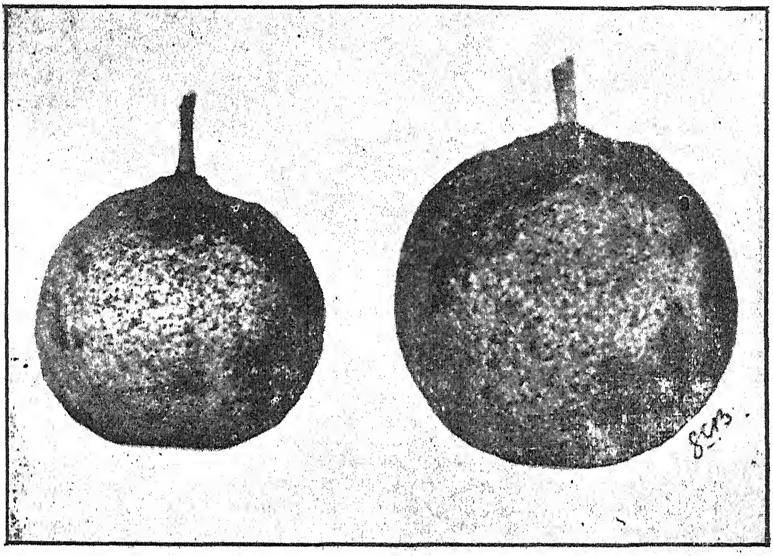
large numbers they weaken the trees by the drain they exact on the leaves and the fruit. Like most such-like insects, the thrips require for its excessive multiplication dry, hot weather. After the first few showers when the rainy season sets in they are washed off. Kerosene emulsion and such-like sprays destroy the full-grown insects, but sulphur is the most reliable and the best remedy. The plants attacked should either be dusted with sulphur or they should be sprayed with some sulphurous wash such as—

Sulphide of Potassium	1oz.
Water	1gal.

or as a substitute for the sulphide of potassium (liver of sulphur of com.) with bi-sulphide of lime wash. This can easily be concocted at home by boiling in a small quantity of water, lime and flowers of sulphur for half an hour. The following quantities will be found sufficient:—

Quick lime	5lbs.
Sulphur	5lbs.

Boil till dissolved, when it will turn amber colour, then add water (100 gallons) and spray.



THE INSECTIVOROUS BIRDS OF WESTERN AUSTRALIA.

By Robert Hall.

STILT WALKERS.

If the idea that all interesting birds perch in trees is abroad, it is a false one. Many roam our paddocks and feed upon ground loving larvæ, with as much diligence as do the branch hunting forms in the leafy domains. It is to certain terrestial species we are greatly indebted for a service not rendered by other than a wader: the term applying to the bird when on land just as in the swamp. To value such a bird, take for example a Straw-necked Ibis; a colony of which we know to have consumed twenty and one-half tons of grasshoppers a day for months in succession. Others work for good, equally as well, in proportion to their numbers. All waders are not so valuable to us, and most of these are protected by the Game Act for a limited period of each year. Certain of them are protected throughout the year, and it is well. For our present purpose the Ibises, Herons, Plovers, and Bustard are typical of wading birds that positively do no harm, and without doubt do an immense amount of good. The species of Plovers and Herons, mentioned below, are the inland and not the seaside residents.

Straw-necked Ibis.

Carphibis spinicollis, Jameson (Kar-fi'bis spi-ni-col'is).

Karphos, a small dry body; *ibis*, ibis a bird; *spina*, a spine; *collare*, a collar.

Geronticus spinicollis, Gould, "Birds of Australia," fol., vol. vi., pl. 45; "Key to the Birds of Australia," Hall, p. 97 (1899).

Geographical Distribution.—Australia, except Tasmania.

Key to the Species.—Adult: head and throat bare; long stiff yellow shafts on the fore neck; hind neck feathered to nape; general colour above, black glossed with steel green on upper back and mantle, and purplish on scapulars and wings; the long upper tail coverts and tail feathers white; wing coverts and quills black, barred with bronze externally; centre of neck, breast, and abdomen white. Total length, male, 29 inches; female, 27 inches. Young: head and neck feathered; back, sooty black; under surface, white.

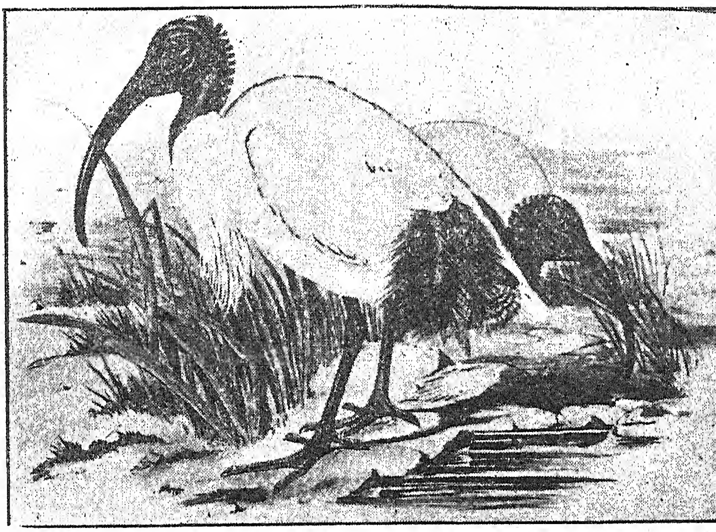
There are three species of Ibises in our State. One is glossy deep rufous, known as the Glossy Ibis. The other is white in its general appearance, and called the White Ibis. In addition, there are Spoonbills; useful birds.

They are graceful and gregarious. During great drought large flocks leave the drying parts of the country and pass into other territories.

During the summer of 1900-1901 they massed near Exmouth Gulf in one part of the continent, and Port Phillip Bay on another.

In the region of these two places large rookeries formed, and advantages accrued to the residents.

The strongest case in favour of the Ibis, as a joint suppressor of plagues, may be quoted from the *Victorian Naturalist* February, 1901, and due to the research of Mr. D. Le Souef, C.M.Z.S. The colony was nesting in a swamp near the Murray River, and in the swamp of two to three feet of water were polygnum bushes from six to ten feet high.



STRAW-NECKED IBIS.

Mr. Le Souef says: "The birds occupied about 400 acres of a swamp of 600 acres, and it was an interesting sight watching the various companies continually leaving and returning; some flew high, others again lower, and each flock numbered from three to about forty birds. As the swamp was approached, a curious sound, something like the breaking surf on the shore, was heard, caused by the immense numbers of birds flying about and emitting their hoarse cry; but comparatively few birds were seen flying above the lignum, and one could tell that such a vast host of birds was nesting there. And after having been all through the swamp and carefully noted the numbers on a small area, both Dr. C. Ryan and myself, as well as the manager of the station on which the birds were, came to the conclusion that the minimum number was 200,000. Of course, only one-half of the birds would be in the swamp at one time, as the other half would be away feeding. No illustration we could show would give much of an idea of the number of birds or extent of the rookery unless a photo was taken from a balloon or

some such eminence, for even when a gun was fired only those in the immediate vicinity, say, of sixty yards, would rise, and not even all those unless they caught sight of the intruder; they would then circle round at a considerable height, but would soon settle again. The noise of the wings of the birds as they flew past was similar to the rustling of silk. The Ibis which first arrived started nesting in the middle of the swamp, and as fresh arrivals came so they had to build on the outskirts of those there before them, consequently the centre nests would have fully fledged young ones in, while at the outskirts late arrivals were only building.

The parents feed the young by placing partially digested food in their mouths, which food consists of grasshoppers, caterpillars, freshwater snails, etc., and if the young birds are handled much they occasionally eject the food from their stomach. The contents of an average crop of an adult bird contained, by actual counting, 2,410 young grasshoppers, five freshwater snails, several caterpillars, and some coarse gravel, which, if you multiply by 200,000, brings up a total of 480,000,000 odd grasshoppers, as well as vast numbers of caterpillars and snails. These latter are the hosts of liver fluke, which sheep so easily get in certain damp localities; and one must remember that this is going on every day, so a little idea can be formed of the immense utility these birds are in destroying noxious insects."

Nest.—Flat and loosely made of twigs or leaves, and placed on a low bush, or on the ground of an islet in flooded land.

Eggs.—Four or five to a clutch; white; length 2·5 inches, breadth 1·5 to 1·8 inches.

White-Fronted Heron.

(*Blue Crane.*)

Notophoyx Novæ-Hollandiæ, Lath. (*Nó-tó-foix nó-vé-hol'an-di-ē.*)

Noton, the back; *phoxos*, tapering to a point; *Novæ-Hollandiæ*, of New Holland.

Ardea Novæ-Hollandiæ, Gould, "Birds of Australia," fol., vol. vi., pl. 53; "Key to the Birds of Australia," Hall, p. 98 (1899).

Geographical Distribution.—Areas 9 to 1, inclusive.

Key to the Species.—General appearance slatey-grey; forehead, eyebrow, and throat white; dorsal plumes grey; sides of chest vinaceous; breast plumes lanceolate; a full crest; tarsus not twice the length of outer toe and claw; middle claw pectinated.

Closely allied to this species is the Blue Reef Heron. It is a heavier bird and has a pure white streak down the centre of the throat. In our present consideration one is much superior to the other. The Reef Heron keeps to the sea. Herons, Bitterns, and Ibises are a useful working medium in all swampy country, but the best of all without any doubt are the former, and standing at their head for usefulness is the White-fronted Heron. I have observed their capacious stomachs crammed with grasshoppers, and Dr. Cobb, of New South Wales, speaks of them as fluke-eaters, while the

animal is in its host, Bulinus (a fresh water mollusc). This species plays its part ably when the balance of nature seems disturbed.

The shooting of the Heron for sport is a serious mistake by those who carry a gun for, very often, misdirected recreation. Surely a little observation would convince anyone with common sense that the Heron carefully patrols every watercourse for snails, or the fields for grasshoppers, moths of destructive grubs, etc. I have repeatedly watched solitary pairs, and to absolutely prove the above results I have shot them for that purpose. In any case I have found them to have well-filled stomachs of one or other species of animal that is vermin to the agriculturist. The grazier unconsciously feels the result as much as anyone. As an instance, in recent years many species of freshwater snails have been discovered to house the "fluke" that eventually gets to the liver of the sheep. The flukes finally leave the snail and go on to the grass, when grass and fluke are eaten by the first flock of sheep that comes along. The White-fronted Heron has a say in this matter, because it is fond of snails, thus saving the sheep, and perhaps the grazier. It is a pleasing sign to see Herons when the grasshopper horde has appeared, for the birds work wonders. Too much cannot be said in favour of the White-fronted Heron.

Nest.—A flat structure of sticks and leaves, placed upon a small horizontal fork, or in a broad upright fork of a fairly large tree.

Eggs.—Four to a sitting; uniform bluish-green colour. Length 2 inches; breadth, 1·4 inches.

Stone Plover.

(*Land Curlew*).

Burhinus Grallarius, Lath. (*Bu-rhin'us Gra-la'ri-us.*)

Bu, from bous, an ox; *rhis* (*rhinus*), the nostril; *grallæ*, *stilts*.

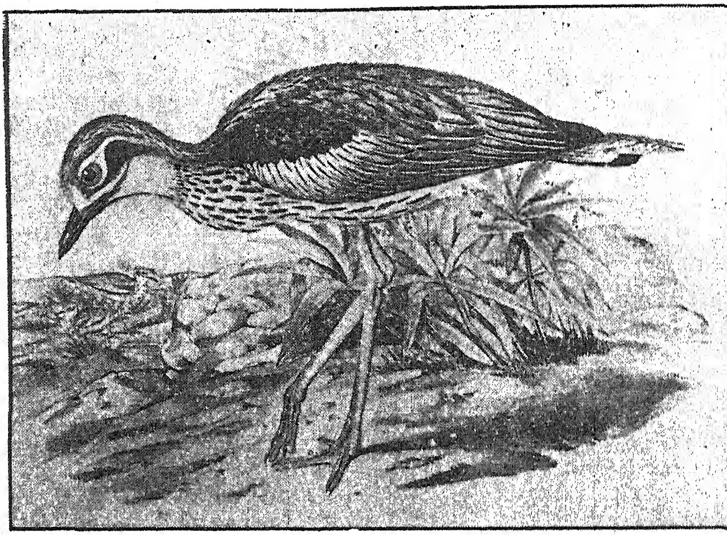
Œdicnemus grallarius, Gould, "Birds of Australia," fol., vol. vi., pl. 5 "Key to the Birds of Australia," Hall, p. 79 (1899).

Geographical Distribution.—Areas 9, 8, 7, 6, 4, 3, 2; accidental in 5.

Key to the Species.—Upper surface, ashey-grey, much streaked; lores, narrow eyebrow, and a spot below eye, white; black and rufous line across the eye and ear coverts; cheeks reddish-brown; hind toe absent; bill shorter than head, apical portion swollen and forming marked dertrum, the apical curve of genys ascending gently. Total length, 20 inches.

The Curlew is the largest of our Plovers and is generally to be found upon the ground, running just as Plovers do, and living under conditions very little altered. While the bulk of Plovers prefer the plain, the present species will frequent either the timber country or the grassy open, where its long legs are specially useful. It is the proprietor of the weird call "wee-loo" or "cur-loo" that the bushmen hear in the night. It is only a nocturnal bird to the same extent as the ducks, geese, and waders in general are night birds.

The habits are not the same as those of an Owl or the "Morepork," although it feeds at night as well as by day. The Stone Plover is a stately bird while walking across the plain, and if disturbed the pace will change into a rapid run. Often it will bring its great power of mimicry to bear in self-protection by choosing a place that harmonises with its colour. Assuming a rigid form in almost any peculiar position it will remain very quiet till the danger has disappeared. Hawks are its natural enemies, and it is ever on the alert for them. Sportsmen know how difficult it is to approach within gunshot range, and the strategy required to outwit it. Generally a pair only associate; at other times six to eight birds, or even as many as fifty are said to have been seen in a flock in the winter. The food of the birds is insects, ground fruits, etc.



STONE PLOVER.

Nest.—Simply the bare ground in lightly timbered country.

Eggs.—Two to a clutch. They are subject to much variation in the ground colour between a light stone and a dark one, both having brown spots and irregular blotches upon them to a greater or less degree. Length, 2·2 inches; breadth, 1·6 inches.

CHEESE-MAKING.

By A. Crawford.

It has often been said that the climate and pasture of West Australia was not suitable for cheese-making, and that it was no use attempting to make it here. As for some years past no cheese was made in the State it was impossible to prove it by actual demonstration, but from what I have seen and known of the country I could see no reason why cheese of the best quality could not be made, and for years have been urging on the dairy farmers, especially those rather remote from the railway stations, to go in for it as it would pay better than butter. Late in last season a private cheese factory was established a few miles out from Busselton, and the first of the cheese was sent to Perth last month and disposed of by public auction. That cheese-making can be successfully carried out here and the best quality of cheese made was amply demonstrated by the fact that the consignment brought top prices, which must be most satisfactory to Mr. Spurge, the proprietor of the factory, and should also prove to others that there is money in cheese-making. The Busselton cheese brought 9½d. per pound, or equivalent to 2s. 4½d. for butter if the milk of common cows is used. Of course where Jersey cattle or crosses of the Jersey are used, the butter returns would be much greater, and there would not be nearly such a difference in favour of cheese-making.

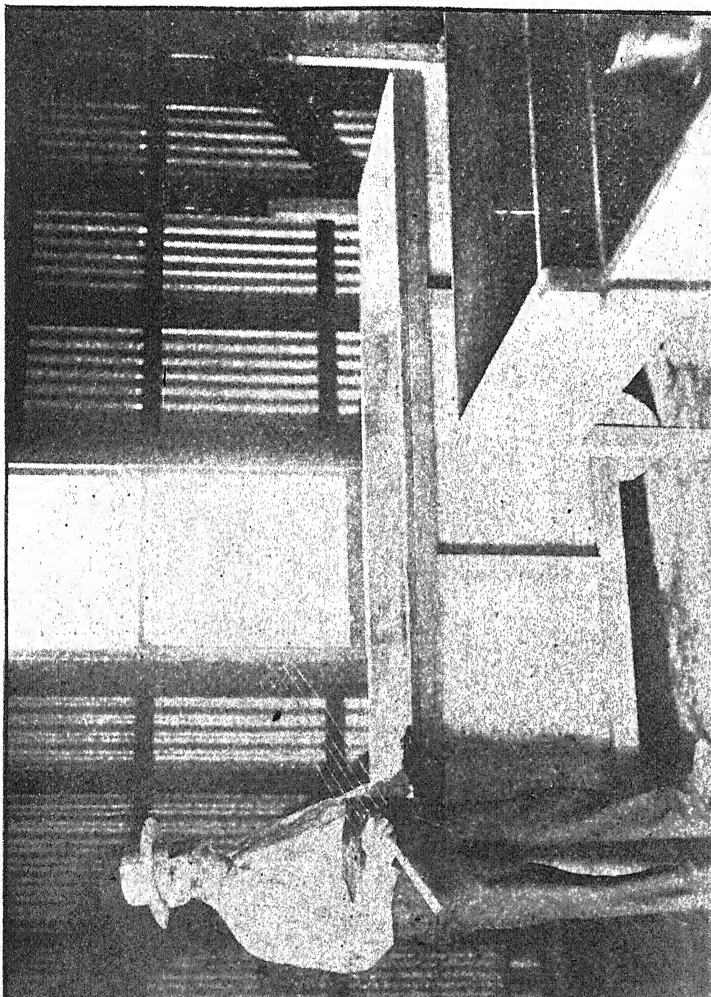
At the present rates of butter and cheese it would pay much better to make cheese than butter. At the same time I can scarcely advise very small farmers to go in for it, as there is a considerable amount of time taken up in its manufacture, the quantity of milk to be treated making little difference in the time of making. Thus the actual time taken up in making fifteen gallons of milk will be practically no less than that taken up by making one hundred gallons of milk into cheese. The only extra time will be in dealing with the curd and the daily turning of the cheese afterwards. I would not advise the starting of cheese-making on a less supply than 40 to 50 gallons of milk per day. The cost of a plant to treat a hundred gallons would be little more than one to treat a less quantity. One great objection I have met with in nearly each case is that none of the dairy people understand the making of cheese, and are afraid to start it; but that difficulty can easily be overcome, as I am sure the Agricultural Department would send someone qualified to teach the process to any one desirous of starting the industry. The process is not a difficult one to learn, but it is one requiring a considerable attention to detail, and for that reason women frequently make better cheese-makers than men. The work is not severe, but is work that has to be done each day for several hours, and a strong girl of 16 or 17 should be quite equal to it. Cheese-making cannot be learnt in a day or two; the outline of it may be, but it is only by experience that a good cheese-maker is

produced. To a person of ordinary intelligence a week or a fortnight's teaching should be enough to put them in the way, and if notes are made on each day's work, and these studied and the results compared, there is no reason why in a very short time a regular and uniform cheese should not be turned out.

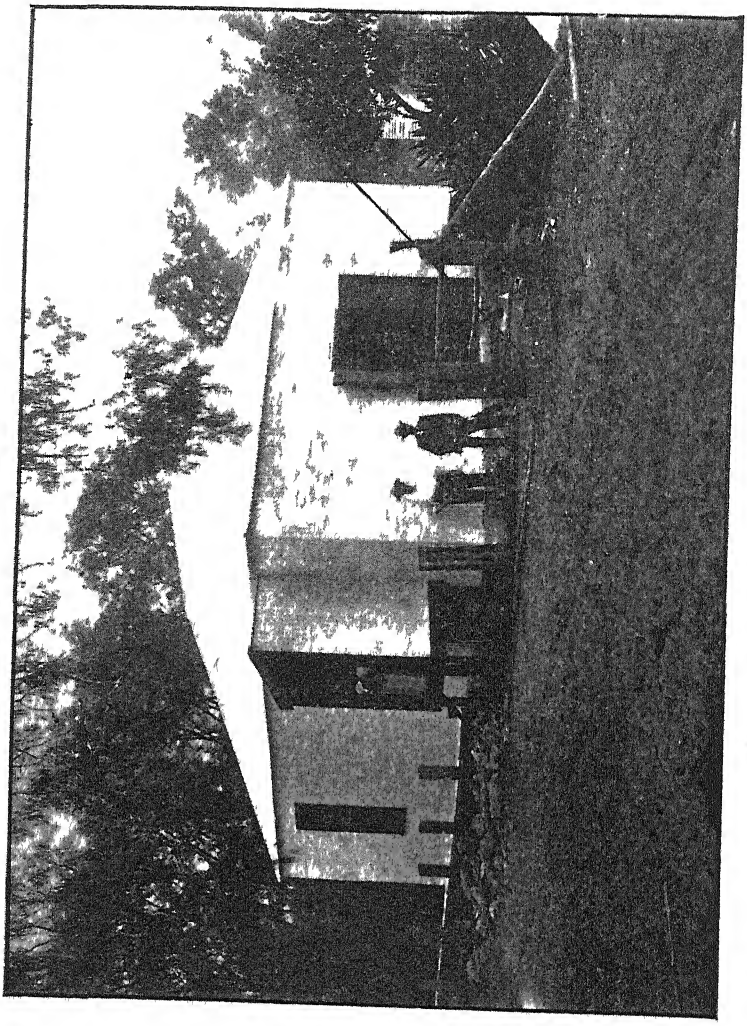
The following is the usual method adopted for making cheese known as Cheddar, on the farms, but in the large factories the system is slightly different, although the principle is the same :—

To make the best cheese we want the whole milk, that is, milk without any cream having been taken from it. Then it is always advisable to have some of the night's milk to mix with the morning's, or if the weather is very cool, milk a day old, mixed with the morning's, will do no harm. The milk is now put into what is called the vat, or by some people the tub, and the temperature of the whole raised to 80deg. Fahrenheit. Colouring matter is then added, according to taste, which varies from 3ozs. to 4ozs. fluid to the 100 gallons. This is thoroughly mixed until the milk attains a uniform colour, and the rennet is then added, according to its strength, and also according to the quantity of old or new milk you have; the more new milk the more rennet, the more old less rennet is required. Stir thoroughly now, and allow to settle, keeping the surface gently in motion to prevent the cream rising; if the cream rises now it will be lost in the whey. As soon as the milk shows signs of thickening, cease moving the surface, and allow the milk to set for about 40 minutes. Then cut the curd with the horizontal and vertical curd knives, and by this means you avoid having to use the curd mill. Allow the curd to settle and whey to rise for about five minutes, and then heat your vat up to 100deg., keeping the curd in motion every now and again to prevent packing—sticking together. This process is now called cooking the curd. In the early stage the curd is soft, and requires gentle handling, but after a time it begins to get firmer and contract in size, the reason of this is the whey is being expelled from it. The time it takes to cook the curd thoroughly will vary from half an hour to eight or nine hours, according to the maturity of the milk employed; but an average is about two to two and a half hours. To tell when the curd is ready for taking out is one of the principal things in cheese-making. At first the whey will have a sweet sugary taste, then it will gradually lose that, and an acid taste will be developed. It is just at this stage that the experienced cheese-maker has the advantage over the novice, as he can tell the exact time to stop. Never allow the acid taste to get strong, but take your curd out just at the turn as near as possible. Should your curd get firm and have an Indiarubber-feel and appear quite dry when broken, before the change takes place, better take it out, the acidity will develop after if not salted too soon. If, however, the acidity comes before you notice it, take out the curd as quickly as possible and salt at once, adding half as much more salt as usual. When the curd is taken out it is put on what is called the strainer or cheese-cloth, and the whey allowed to drain off. The curd is frequently turned and allowed to cool, then salt is added in the proportion of two and a-half pounds to 100 gallons of milk. After this the curd is put into the hoops, and gentle pressure applied. After about an hour the curd is taken from the hoop and the bandage put on, then put back in the press and full pressure applied. It is allowed to remain about two days, and then taken out and stored in the cheese room. The temperature in this room ought to be kept as nearly as possible at 65° all the year round, and the cheese turned each day. Should the temperature rise, the newer cheeses ought to be turned twice a day. If during the process of cooking a musty smell is given off, some of your milk has been rather old or you have put in milk from a cow too freshly calved. Should some of your milk be rather old, cook at 95° so as to retard the acidity. If you wish to feed your whey to calves, it ought to be taken off before the acidity comes; if after, it is apt to scour badly, it requires something added in the shape of flour, meal, treacle,

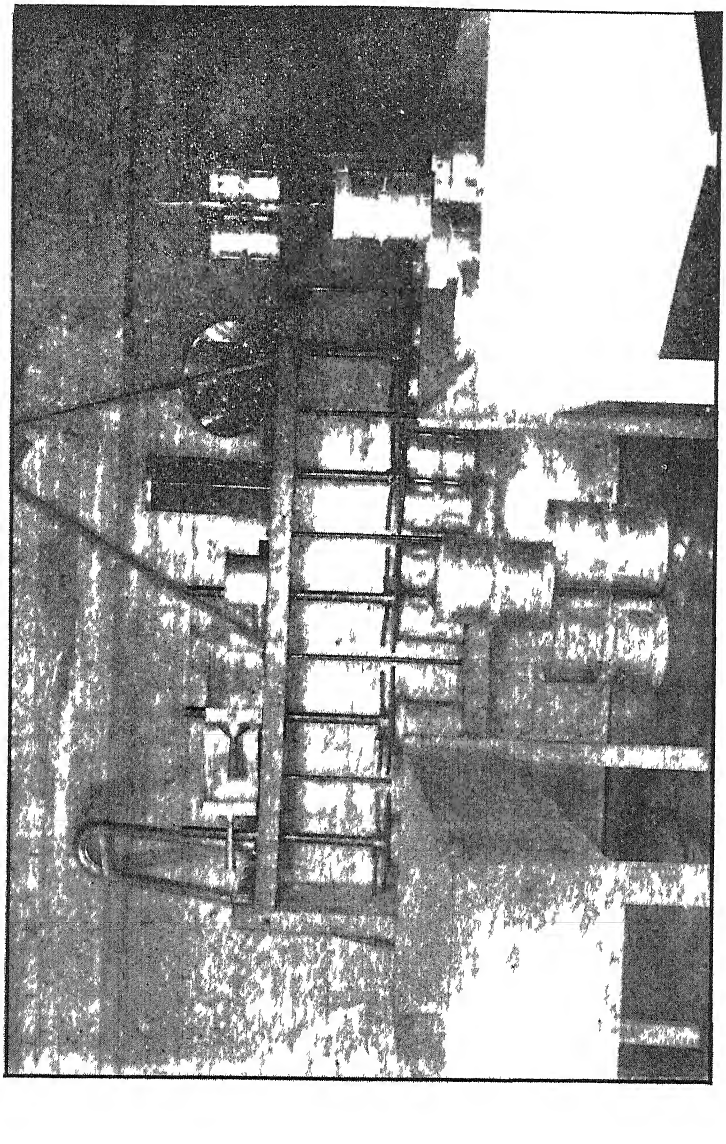
or linseed. If the milk has been robbed of some of its cream, run the whey off some time before the acidity comes, and let the acid develop in the curd by keeping it warm. It will require to be put through a mill or cut with a knife again. Should you make cheese with robbed milk or some of the cream taken off, you can partly prevent its getting too hard in the maturing by keeping the temperature up to about 80°. The richer your cheese in fatty matters the lower the temperature it ought to be matured in. If you wish to hurry the maturity so that it may be ready for cutting at about two months, it can be done by adding more rennet when setting the milk. About three months is required as a rule, all the better if a little longer. Small cheeses should be made for use in summer; the larger ones should only be made for winter use. The milk from cows newly calved should not be used for cheese-making for at least seven days.



Vat and Curd Knife.



Mr Spurge's Cheese Factory, near Busselton



Hoops and Press

NATIONAL SHOW OF PRODUCE.

Second Year.

AN INTERESTING DISPLAY.

DESCRIPTION OF THE EXHIBITS.

YORK DISTRICT SECURES CHAMPIONSHIP PRIZE.

(*West Australian.*)

The second annual national show of produce was opened in the Queen's Hall on Thursday, 6th March, and the Department of Agriculture, which has control of all the arrangements in connection with the event, had considerable reason to be satisfied with the appearance the hall presented when the doors were thrown open to the public. Every available inch of the hall was occupied, testifying to the enthusiastic spirit with which the efforts of the promoters to make the display a representative one had been seconded by the producers themselves. The result was a really impressive illustration of the rich productiveness of the soil of the State. The number of entries was 1,015, this being a considerable advance on last year, and it is becoming very evident that enlarged accommodation will have to be secured for future exhibitions.

The compass into which it was necessary to include the display of farm, dairy, garden, and orchard produce, as well as the exhibits of manufactured articles made from locally-grown products, was, however, not too small to preclude effective arrangement. For the purposes of the show, the State was divided into districts, and the excellence of this scheme was fully demonstrated yesterday. This plan made the show much more interesting than it would be if all the exhibits were arranged together according to their particular class. The space allotted to each district was a show in itself, and a spirit of healthy rivalry was engendered. The districts represented were:- -York, Northam, Blackwood, Fremantle, Swan, Victoria, Wellington, and Beverley. A championship prize was awarded to the district showing the best collection of farm, garden, and orchard produce, and this was won, for the second year in succession, by York, Northam being second. In order to encourage producers to contribute to the collection, first, second, and third-class certificates of merit were issued by the Department for the best exhibits in each class. The certificates were awarded, irrespective of the district, for the best sample of wheat, etc.

THE EXHIBITS.

An exhibit of considerable interest was that of the Department of Agriculture. On the stage was displayed 80 varieties of wheat

in grain and in sheaf, and a large collection of fine-looking melons, pumpkins, tomatoes, gourds, etc. In the gallery, the visitor had an opportunity of examining different insect pests under the microscope, an officer of the Department being in attendance, and supplying all the information desired. Other features of the display in the gallery was the labour-saving appliances, dairying plant, etc.

Along the north side of the hall the produce from the York district occupied a considerable amount of space. The exhibit of flour in this section, by Quigley and Edwards, was allotted the first prize. In the collection of fruit there were several first prizes, the samples forwarded by K. Edwards being perhaps worthy of special mention; while the peaches shown by W. T. Davies and M. Nesbit were of fine size and quality. A creditable place was taken in this section by C. A. Harvey and Co., with bacon and hams, and by Mr. R. G. Burges, M.L.C., with a sample of compressed hay. A fine display of cereals, and the chaff of W. and H. Collins secured the first prize. A dressed sheep, weighing 114lb., shown by Mr. W. Linto, was an interesting feature of the York section, in which were also comprised exhibits of wool, home-made bread, butter, vegetables, etc.

Conspicuous in the section devoted to the Northam district were, of course, the grain exhibits. There were a dozen entries of wheat, while oats (Calcutta and Algerian), white crushed oats, English barley for malting, and wheaten and oaten chaff were represented by numerous samples. Mr. Viveash exhibited splendid specimens of sandalwood. A fine collection of native grasses, from towards Hine's Hill attracted attention, and those connected with the brewing trade were interested in a specimen of native hops. The varied collection of fruits shows what Northam is capable of in this respect, and of preserves, dried fruits, chutneys, sauces, and vinegar there was a profusion. Worthy of notice was a cart wheel made by Mr. Withnell, Northam, from local wood. Mr. Withnell also showed an invention of his own—what he claims to be anti-friction metal. On the wall were suspended pretty clay modellings of flowers by Northam school children.

The Fremantle district was responsible for a varied and choice selection of produce. Mr. W. A. Chamberlain, Hamilton-road, Fremantle, was represented by a nice collection of pumpkins, melons, mangel wurzels, passion fruit, egg fruit, and beet root. The name of R. Simper, Jandakot, appeared above samples of maize, wheat, and oaten chaff, oaten hay, tomatoes, peas, and three varieties of oats. Excellent samples of rhubarb were exhibited by Mr. S. Dixon, Bibra Lake, in whose display tomatoes, pumpkins, and lemons were prominent. Mr. A. Carlson assisted to give proof of the fertility of the soil in the Jandakot district with a display of vegetables. Of tomatoes, Messrs. J. B. Mell and Sons had the most interesting exhibit in the show. They showed no fewer than 33 varieties of tomatoes, the red currant and Turk's Turban tomatoes attracting much notice. Nine varieties of apples were also on view

in this collection, while samples of vegetables had also been sent from the Woodlands orchard and vegetable garden, which is situated three and a half miles from Fremantle. Mr. J. A. Hicks exhibited specimens of sorghum, which seems to do well in the Jandakot area. Included in his exhibit were maize, pumpkins, and melons. A collection of vegetables from the Jandakot Agricultural Society also appeared in this section. Mr. F. McDonald submitted samples of wheaten and oaten hay, while Mr. James Caporn added to the Fremantle division an exhibit of maize. Holmes Bros. took their share in illustrating the products of the Fremantle district, by displaying samples of blood manure, bone dust, and neatsfoot oil, this firm utilising in these products the most up-to-date machinery. Manufacturers took a prominent position in this section. H. Albrecht and Co. demonstrated the usefulness of West Australian woods in the manufacture of brushware. In brushes designed for a variety of uses and revealing excellent workmanship the handles have been made from local woods. The same remarks apply to the display of Mr. K. McKenzie, manufacturing saddler. Complete sets of harness were shown for every description of work, all made from colonial leather, and apparently completely fulfilling all requirements as to style, finish, and durability. In the manufactures portion of this section, Ross and Co. (vinegars, jams, etc.) and Mills and Ware (biscuits and confectionery) have noteworthy exhibits. A creditable fact with reference to the Fremantle section is that the comprehensive collection of the district's products was, we were informed, the work of only two days.

The Blackwood producers were principally represented by fruit, Mr. J. Walter being the largest exhibitor in this class. Altogether seven or eight prizes went to this section. This district being so late, affected the show of apples. In this class Mr. George Allnutt was a prize winner. There was also an extensive display of vegetables. Grain was a prominent exhibit in the Beverley section. The collection of fruit, while making a creditable display, was not quite complete, a quantity, through railway delays, not having arrived. The display included bottled oranges and lemons. Conspicuous in the exhibits of fruit included in the Swan district section, was an excellent collection from the Woodbridge nurseries. The exhibitors of fruit also comprised the Illawarra Company and the Darling Range Fruit Growers' Association. Displays of wine and honey were features of the section—wine from the Santa Rosa Co., and honey from the Guildford Bee Co. Mrs. C. Harper was one of the principal exhibitors in the Swan section with home-made jams and sauces in patent air-tight preserving jars, collections of dried fruits, and ham and bacon. Mr. W. Padbury, Guildford, had an interesting exhibit of flour, wheat, bran and pollard. Couche, Calder, and Co. displayed samples of artificial manures manufactured in the Swan district. Vegetables, fruit, and flowers from the Swan district were shown by Mrs. Wellman, and amongst the manufactures displayed in this section are aerated water and terra-cotta brickwork. The exhibits from the Wellington and Victoria districts were arranged on tables in the centre of

the hall. From the Wellington district the display consisted chiefly of fruit and vegetables, while samples of wine were also on view.

Apart from the district exhibits, Messrs. W. Sandover and Co. had a large and interesting display in the gallery of poultry and bee appliances, spraying apparatus, etc. E. and J. Myers had an excellent show of sauces, pickles, and vinegars. R. Bechtel and Co. provided an interesting spectacle in saddlery made from colonial leather, and A. Berryman and Co. were showing a very large assortment of boots and shoes made at the Perth factory from colonial leather. Messrs Purser and Co had arranged in a side room an interesting collection of ploughs, harrows, etc., and the Massey-Harris Co. were also exhibiting agricultural implements. Mr. E. Symonds displayed a variety of seeds. On a centre table an interesting exhibit had been arranged by the Darling Range Quarry, Fire Brick and Gravel Company. C. and H. Smith, of Baker's Hill, had a collection of honey and bee products. Messrs. T. R. Lowe and Co. had been awarded a gold medal for a splendid collection of fruits gathered from all parts of the State. In the body of the hall Messrs. Burford and Sons, soap and candle manufacturers, Victoria Park, had a show case exhibiting the various articles of their manufacture.

The following gentlemen acted as judges ;—Grain, cereals, and seed, Mr. W. Paterson (manager Agricultural Bank) ; hay, chaff, and ensilage, P. Gardner (Gardner Bros.); vegetables and roots, J. Doscas (W.A. Produce Co.) ; fruit, Mr. A. Despeissis, M.R.A.C., vit. and hort. expert, Mr. Jefferson, fruit inspector; jams, preserves, sauces, and pickles, Messrs. T. R. Lowe and J. James; flour, Mr. A. Gorrie, Fremantle; wine, Mr. W. Carpenter (Milne and Co.) ; honey and bee products, Mr. R. Woolf, Perth; butter and bacon, Mr. T. R. Lowe; miscellaneous, beer, etc., Mr. F. Craig; leather and hardware, Mr. R. Smith; articles manufactured from local timber, Mr. McMahon (Daniel White and Co.) ; brushware, Mr. J. James (Sandover and Co.) ; soap and candles, Mr. J. James (Sandover and Co.) ; poultry and bee appliances, Mr. A. Crawford (dairy expert); spraying apparatus, Mr. G. Buchanan (fruit inspector) ; manures, Mr. P. Wicken (field officer) ; botanical, Dr. Morrison, (Government botanist) ; wool, Mr. G. G. Holmes (manager Connor, Doherty, and Durack) and Mr. Cruickshank, Claremont.

THE OPENING CEREMONY.

Speeches by the Governor and Minister for Lands.

The opening ceremony took place a few minutes after 3 o'clock, when there were on the platform, in addition to His Excellency the Governor, the Acting-Premier, Mr. W. Kingsmill, M.L.A.; the Minister for Lands, Dr. Jameson, M.L.C.; the Colonial Secretary,

Mr. F. Illingworth; the Bishop of Perth, Dr. Riley; Mr. G. Throssell, M.L.A.; Mr. T. F. Quinlan, M.L.A.; and other gentlemen. There was a fair gathering at the opening.

The Minister for Lands said that before asking His Excellency to open the exhibition he would like to make a few remarks on the inauguration of the National Exhibition. The first exhibition was held last year at the suggestion of Mr. Throssell, who was then Minister for Lands, and it was such a success that it was decided to hold a second National Show this year, and they saw the result before them that day. (Applause.) He knew there had been a great deal of discussion among agriculturists as to whether it was wise to have a show every year, or whether it would not be better to have an exhibition every second or third year. It was a somewhat difficult matter to decide, for there was a great deal to be said on both sides. No doubt, it was a tax on our agriculturists to expect them to bring up exhibits year after year, and, seeing there were so many agriculturists visiting the metropolis about this time, he would be glad to hear an expression of opinion on the matter from them before they went back to the country. (Hear, hear.) The advantages of such a show were very great indeed, if for no other reason than that it focussed agricultural interests in one place for a time, and all those interested in the agricultural industry, or a great many of them, could come together and discuss the various questions that arose in connection with their interests. In addition, its educational value was very great indeed. For instance, they had on the platform before them the productions of the Government experimental plot at Drakesbrook, which was 70 miles South of Perth. It was wonderful the number of crops and varieties that could be raised there, and the work done in experimenting on crops and soil was of great and practical value. He (the Minister for Lands) and his colleagues were prepared to advance this direction of the work of the Agricultural Department very considerably, and have additional experimental plots established, one in the northern district, one in the eastern district, and one in the Southern district of the State to experiment with crops, and see what the soil in those particular districts would grow, and what it was best suited for. The officers of the department had carried out a good idea in displaying around the galleries of the hall diagrams showing the amount of importations into Western Australia of cereals, wines, dairy produce, etc., and comparing it with the amount produced in the State. He was sure that if they studied the figures they would be struck with the enormous scope in this State for agricultural products. He did not suppose that in any part of the world there was a better opportunity and better prices to be obtained for agricultural products than in this State. He referred to the value of manures, and said that this was a side industry that had to a certain extent been lost sight of. They would see before them the class of manures suitable for a light soil. He might say that they hoped before very long to see private firms taking up the industry of manures for agricultural purposes, particularly as we had enormous deposits of guano, which by a simple

chemical process could be made the most valuable manure for the soil of this State that could possibly be obtained. This would no doubt come about, but the matter wanted to be pressed forward. There were also on view in the gallery of that hall a number of microscopic slides showing the pests and diseases common in Western Australia. Unfortunately, there were a great many pests and diseases here. An unfortunate thing was that the fruit and the vegetables that had been imported into the State from time to time had been imported with pests, but without the parasites of those pests to keep them in check. That was a serious matter. But the department had a very able entomologist, and he had gone to the Eastern States for the parasites which would destroy these pests. (Applause.) A very curious thing was that pests common to the State had their own parasites. It was only those pests introduced without the parasite that had proved such a danger to fruit growers and gardeners. All those interested in the subject should study the slides, and an officer would be ready to explain in detail the nature of the pest and parasite. If the growers knew the name of the pest the department would tell them the remedy, and in that way a great deal could be done to keep down pests in this State. In regard to the Mediterranean fruit fly, the Government had already sent to Italy to secure the parasite of that fly, and hoped in a short time to eradicate it from the country. (Hear, hear.) Continuing, the Minister said that a number of those who had exhibited last year had not done so this. He had just come back from a visit to the South-Western District, and, in answer to his queries, had been told that it was due to the fact that at the auction of produce at last year's show there was a considerable loss. To obviate this, the department had arranged that after 7 o'clock on Saturday night the producers could sell their own produce privately. If any wished to sell by auction as before, no doubt that could be done. A satisfactory entry had been received for the prize for the best district court. The first prize had been awarded to York, with 479 points out of a possible 1000; Northam being second, with 442 points, and Wellington third, with 390 points. It was very creditable, indeed, to York, which district also secured first prize last year. (Applause.) Referring to the various sections, the Minister said there were a great many exhibits this year, the total numbering 1,015. (Applause.) He thought that a very large number indeed, and it was considerably over the number of exhibits last year. Adverting to the enormous amount of imports of products that could, he said, very well be produced here, he stated that the value of cheese imported for nine months of last year was £21,791; butter, £178,583; preserved milk, £50,574; cattle for slaughter, £106,179; and so the list went on. For the nine months, £996,822 worth of produce had been brought in. That showed the enormous scope in this State. The market had not only to be considered for our own home consumption, but now having the first and last port of call in Australia, the amount we could send away in the great mail boats would be something enormous in time to come. He was informed that the amount of exports might in time reach

£10,000 a week in produce. That was a considerable market in itself, besides the great market of the goldfields. He thought very great credit indeed was due to the officers of the Agricultural Department for the departmental exhibits, and for the excellent arrangements for the whole exhibition. The whole of the arrangements had been carried out, he believed, by Messrs. Despeissis, Wicken, and Crawford. He paid a warm tribute to the memory of the late Mr. L. Lindley-Cowen, secretary to the department. Undoubtedly it was a great deal due to the work Mr. Cowen had done in the past that they had such a show that day. Mr. Cowen had been the very life and soul of every movement of that kind. Not only did they mourn his loss because of his personal characteristics, but they felt it would be hard indeed to fill his place.

His Excellency thanked the gathering for the kind reception accorded him, and expressed his pleasure at being present on such an occasion. He believed he was right in saying that it was only comparatively recently that the possibility of developing the agricultural industry in this State on any extensive scale had received serious consideration, and he thought that his statement was indorsed by the fact that the Agricultural Bureau, which had grown into a department, had only come into existence during the past few years. It was, he thought, very satisfactory to realise that agriculture and horticulture had obtained such a position in the industries of the State as to warrant the establishment of such a department, and also to know that its work was steadily increasing. He sincerely hoped that the scope of that work might be still more widely enlarged. Although perhaps he would seem to harp on a rather old string, he would again and again urge on the legislators of this country the enormous importance of inducing as far as possible a settled community on the land—(applause)—men whose resources, whose interests, whose work, and whose hearts were rooted in the soil. He believed there was in certain quarters a tendency to disparage the capacity of the soil in Western Australia. Well, pessimistic criticism was a very easy thing, and on this question he was prepared to take his stand among the ranks of the optimists, for he believed that the products of this country would very shortly give the lie direct to the opinion that Western Australia was merely a stretch of sand. (Applause.) He referred to the crops he had seen from different centres, and the fruit from the vineyards and orchards widely scattered over the country, and said those yields showed what extraordinary virtues this so-called sand of ours possessed. He looked forward to the day when what were now stretches of unprofitable bush would be converted into waving cornfields, fruitful vineyards and orchards, and smiling homesteads—(applause)—and he thought he was not over sanguine in his anticipations. He was glad to see that the Department of Agriculture took the same sanguine view that he did. Our climate was perfect; there was an abundant and consistent rainfall, and the soil, though somewhat patchy, was of great fertility, and all that was wanted to bring about the result he looked forward to was energy and science. As to science, the Department of Agriculture was evidently putting into

their way all the latest methods, and all the latest knowledge obtained by experiment and other means, not only to prevent the introduction of pests and diseases, and to cure those that already existed, but so that the industries of agriculture and horticulture might be carried on to achieve the best possible results in the most economical manner. The *Journal* was of great service in this direction. The department also carried on an elaborate inspection of fruit imported into the State, and of all orchards and vineyards, by experts, and also arranged for lectures to be given on several subjects, such as dairying and poultry farming. The department had also imported a lot of stud stock to improve the breed of horses, cattle, and sheep in the country. They might, therefore, fairly say the department was keenly alive to the necessities of the country, and its own responsibilities. (Applause.) He thought they might that afternoon congratulate the officers very heartily on the show, and he had very great pleasure in congratulating them, and in wishing them every success. His Excellency, in conclusion, expressed very sincere condolence and regret at the appallingly sudden and very sad death of Mr. Cowen. The industry had lost in him a true friend, the department an able and valued secretary, and a large circle of them deplored the loss of a good friend. He only hoped that the department would be fortunate in his successor to carry on the work with which he was associated unremittingly and successfully to the advancement and the prosperity of the agricultural industry in this State. (Applause.)

The Governor then declared the show open.

THE PRIZE LIST.

Class 1.—Champion Prize.

District Exhibit.—Best collection of farm, garden, and orchard produce, comprising everything grown, produced, and made on a farm. First prize, £40; second prize, £20; third prize, £10.

The exhibit to be collected by the agricultural societies from produce grown within the boundaries of their respective districts, and to be displayed by them.

York (479 points)	1
Northam (442 points)	2
Wellington (390 points)	3
Swan (324 points)	0
Blackwood (319 points)	0
Fremantle (210 points)	0
Beverley (208 points)	0
Victoria (150 points)	0
Plantagenet (70 points)	0

Wheat.—Alfred Woods, Capel, 1; S. Williams, 2; E. Powell, 3.

Oats.—F. Pearse, Dongara, 1; James Bell, Greenough, 2; Samuel Jupp, Upper Chapman, 3.

Barley.—J. H. Monger, York, 1; James Byfield, 2.

Rye.—Morgan, Northam, 1; W. J. Hastings, Beverley, 2; W. F. Craig, York, 3.

Peas.—E. Ashworth, York, 1.

Millet Seed.—W. H. Lang, Capel, 1.

Sorghum Seed.—A. Ferguson, York, 1.

Wheaten Hay.—A. Ferguson York, 1; J. B. Harris, York, 2; J. and W. Parker, York, 3.

Oaten Hay.—Hon. R. G. Burges, York, 1; W. Linto, York, 2; J. Ronan, Upper Chapman, 3.

Wheaten Chaff.—W. and H. Collins, York, 1; James Rumble, jun., Walkaway, 2; E. Keane, Northam, 3.

Oaten Chaff.—G. H. House, Beverley, 1; J. Sewell, Beverley, 2; J. Carol, Northam, 3.

Mixed Chaff.—L. Lynam, Bridgetown, 1; G. Hamersley, Greenough Flats, 2.

Sweet Ensilage.—John Partridge, Brunswick, 1.

Sour Ensilage.—J. R. Walter, Bridgetown, 1.

Green Lucerne.—L. Lynam, Bridgetown, 1; M. Nesbit, York, 2; Mrs. Dempster, Northam, 3.

Green Fodder.—J. R. Walter, Bridgetown, 1.

Potatoes.—R. Davidson, Capel, 1; J. R. Walter, 2.

Onions.—Mr. Brooks, 1; Illawarra Orchard Co., 2; T. and J. Hurst, Lower Collie, Australind, 3.

Mangels.—R. T. Muir, 1; A. G. Layman, Capel, 2.

Rock Melons.—Nisbet, 1; W. Bird, York, 2; K. Edwards, 3.

Water Melons.—W. Linto, York, 1; W. H. Lang, Capel, 2; W. Smith, Beverley, 3.

Preserving Melons.—J. Taylor, 1; W. Smith, Beverley, 2; J. Kimberley, Northam, 3.

Pumpkins.—Jandakot Agricultural Society, 1; T. Lee, Northam, 2; J. R. Walter, 3.

Vegetable Marrows.—Jandakot Agricultural Society, 1; J. Dixon, Jandakot, 2; W. Smith, Beverley, 3.

Beans.—Illawarra Orchard Co., 1.

Cabbage.—L. Lynam, Bridgetown, 1.

Parsnips.—R. T. Muir, Albany, 1; E. Brockman, Beverley, 2.

Carrots.—R. T. Muir, Albany, 1; K. Edwards, 2.

Rhubarb.—J. Dixon, Jandakot, 1; L. Lynam, 2; J. W. Hackett, 3.

Apples (dessert summer).—K. Edwards, York, Gravenstein, 1; G. Dilly, Capel, Peasgood Nonsuch, 2; E. Keane, Grass Valley, 3.

Apples (summer keeping).—Mrs. H. P. Fry, Benger, Jonathan, 1; J. W. Hackett, Donnybrook, Rome Beauty, 2.

Apples (cooking).—J. W. Hackett, Donnybrook, Reinette de Canada, 1; G. Allnut, Blackwood, 2; J. W. Hackett, Donnybrook, 3.

Pears (dessert).—H. T. Doust, Bridgetown, Bartlett, 1; J. Wellman, Guildford, Elizabeth Cole, 2; J. Whistler, Boyanup, Winter Nelis, 3.

Pears (cooking).—G. N. Morse, York, Vicar of Wakefield, 1; C. Harper, Woodbridge, Keiffer's Hybrid, 2; J. K. Edwards, York, Uvedale St. Germain, 3.

Peaches (clingstone).—C. Harper, Woodbridge, Marguerite, 1; L. Lynam, Bridgetown, 2; G. Allnutt, Bridgetown, 3.

Peaches (slipstone).—K. Edwards, York, Lady Palmerston, 1; H. Doust, Bridgetown, 2; Parke and Lilburne, Donnybrook, Globe, 3.

Nectarines.—Clifton Bros., Waterloo, 1; E. J. Buck, Boyanup, 2; M. Nesbit, York, 3.

Plums.—R. Warburton, 1; Santa Rosa, 2.

Japanese Plums.—K. Edwards, York, 1; W. J. Ecclestone, Boyanup, 2; R. Warburton, Blackwood, 3.

Lemons.—J. Whistler, Boyanup, 1, 2, and 3.

Grapes.—C. Harper, Woodbridge, Almeria, 1; G. Parrant, Perth, Knight's Grand Centennial, 2; J. Wellman, Black St. Peter, 3.

Strawberries.—R. A. Urch, 1, 2, and 3.

Nuts.—K. Edwards, York, 1; W. Linto, York, 2; R. G. Burges, York, 3.

Class 2.—Manufactured Goods (Edible).

Jams and Preserves.—T. H. Wilding, Northam, 1; E. W. Cottin, Northam, 2; Ross and Co., Fremantle, 3.

Sauces and Pickles.—T. H. Wilding, Northam, silver medal; H. Doust, Blackwood, 2; *E. and J. Myers, Perth, 3.

Flour.—Quigley and Edwards, York (silver medal), 1; F. Pearse, Dongara, 2; A. J. Clinch, Greenough, 3.

Wine.—Santa Rosa Wine and Distilleries, Limited (silver medal), 1; Santa Rosa Wine and Distilleries, Limited, 2; Mr. Morgan, Northam, 3. Special first certificate for white wine, Santa Rosa Wine and Distilleries, Limited.

Honey and Bee Products.—C. and A. H. Smith, Baker's Hill, silver medal.

Butter.—W. Dempster, Northam, silver medal.

Eggs.—K. Edwards, York, 1; C. Abel, Blackwood, 2; Thos. Wilding, Northam, 3.

Bacon.—Harvey and Co., York (silver medal), 1; J. McManus, Northam, 2; Mrs. Harper, Woodbridge, 3.

Miscellaneous.—Edmead's beer, Northam (second certificate), 1.

Class 3.—Manufactured Goods (Non-edible).

Manufactured from Produce of W.A. Soil (minerals excluded).—Sandover and Co., Perth (silver medal), 1; Wm. Howitt, Perth (silver medal), 2.

Brushware.—H. Albrecht and Co., Fremantle (silver medal), 1.

Soap and Candles.—W. H. Burford and Sons, Ltd., Victoria Park (silver medal), 1.

Miscellaneous.—R. Bechtel and Co. (silver medal), 1; A. Berryman and Co., Perth, 2; K. McKenzie, 3.

Class 4.—Poultry Appliances.

Collection of Poultry-keeping Appliances—Sandover and Co., Perth, 1.

Class 5.—Bee Appliances.

Best Collection of Bee-keeping Appliances.—Sandover and Co., Perth, 1.

Class 6.—Spraying Apparatus.

Best Collection of Spraying Apparatus.—W. Sandover and Co., Perth, 1.

Class 7.—Manures.

Best Collection of Manures.—Couche, Calder and Co., 1; Holmes Bros., 2.

---

* Subject to declaration that all the articles have been made by this firm from agricultural produce raised in Western Australia.

Class 9.—Native Grasses.

Best Collection of Native Grasses.—W. Mitchell, Northam, 2.

Class 12.—Wool.

H. Wills and Co., Bunbury (silver medal), 1; John Taylor, York, 2 James Inglis, Bridgetown, 3.

Special Gold Medal.—W. McKenzie Grant, Newmarracarra.

Special First Certificate.—A. G. Gillan.

Special Second Certificate.—Mr. T. F. De Pledge.

Non-Competitive Exhibits.

Exhibit of Machinery.—Messrs. R. Purser and Co., 1.

Exhibit of Cake and Biscuits.—Messrs. Mills and Ware, 1.

Special Prize for Educational Exhibit of Fruit.—Theo. R. Lowe and Co., gold medal.

Case of Fruit Packed for Export.—Illawarra Orchard Co., silver medal.

Exhibit of Egg Fruit.—W. H. Lang, 1.

Exhibit of Firebricks and Donnybrook Freestone.—T. Statham, 1.

Exhibit of Tomato Sauce and Chutney.—Ross and Co., Fremantle, 1.

Exhibit of Factory Jams and Preserves.—Ross and Co., Fremantle, 1.

Exhibit of Cordials.—E. and J. Myers, James Street, Perth, 1.

Exhibit of Tomatoes (32 varieties).—J. B. Mell and Co., Fremantle, 1.

Exhibit of Capsicums.—J. B. Mell and Co., Fremantle, 2.

Exhibit of Seeds and Garden Appliances.—Bethell and Thurston, Perth, 1.

Exhibit of Cheese.—W. J. Spurge, 1.

Exhibit of Sandalwood.—Mr. Viveash, Northam, 1.

Exhibit of Dray Wheel.—H. and H. Withnel, Northam, 1; S. Cook, Northam, 2.

Exhibit of Spring Gig.—Victoria Carriage Co., Perth, 1.

Exhibit of Garden and Vegetable Implements.—W. Sandover and Co., Perth, 1.

Exhibit of Labour-saving Tools.—W. Sandover and Co., Perth, 1.

(In the above list, except where medals are specified, certificates were given, the numerals indicating first, second, and third class as the case might be.)

Result of Ballot for the most attractively arranged Court.

York District	488
Northam District	99
Fremantle District	91
Wellington District	80
Swan District...	30
Blackwood District	22
Beverley District	3
Victoria District	2
Informal	41
	856

MANUFACTURERS AND PRODUCERS.

JOINT CONFERENCE.

A joint Conference of Producers and Manufacturers was held in Queen's Hall buildings, Perth, on Friday, 7th instant. The following is taken from a report of the proceedings which appeared in the columns of the *West Australian* :—

Delegates.

The following were the delegates to the Conference :—

Delegates representing W.A. Chamber of Manufactures Incorporated :—President: Mr. W. Dunlop. Ex-Presidents: Mr. W. J. George, M.L.A.; Cr. E. J. Bickford. Vice-Presidents: Mr. J. Hobbs and Mr. C. B. Wright. Treasurer, Mr. O'Dea. Executive Committee: Mr. W. D. Cossham, Mr. C. E. Galwey, Mr. W. M. Gray, Mr. W. H. Hodgson, Mr. E. Hutchinson, Mr. J. Ledger, Mr. J. Phair, Mr. A. J. Rogers, Mr. H. L. Spring, Mr. H. Stone, Mr. D. Sedgwick, and Mr. F. Mallabone. Emergency Delegates: Messrs. Albany Bell, John Colvin, W. Mills, Ronald McKay (York), Ross Rowland, B. Rosenstamm, R. Bechtel, J. Rhodes, A. R. Taylor, J. R. Wicks, H. P. Frost, H. Albrecht, and R. J. Wilson.

Delegates Representing Producers. -- Nelson Agricultural Society: Messrs. J. Inglis, S. C. Davies, and Russell. Albany A. and H. Society: Messrs. J. Cochrane, H. Fairchild, T. P. Handly, and J. Mowforth. Wellington Agricultural Society: Messrs. W. H. Lang, S. Park, E. Gardiner, J. Partridge, W. S. Hales, W. J. Ecclestone, M. Whistler, and F. J. Hamilton. Beverley Agricultural Society: Messrs. T. P. Walker, Horace Smith, E. Powell, and K. McLean. Northampton: Messrs. — Jupp, — Eastough, R. E. Morrell, and J. M. Wilton. Northam Agricultural Society: Messrs. W. J. Stewart, C. R. Knight, G. L. Throssell, A. Watts, — Bartlett Day, and — Solomon. Swan District: Messrs. J. Cramer, G. W. Wickens, and W. Harper. Jandakot (P.O.) Agricultural Society: Messrs. A. Bray, J. C. Anderson, jun., W. E. Spencer, and J. A. Hicks. Wanneroo Farmers and Gardeners' Association, Mr. H. Hocking. York Agricultural Society: Mr. — Stevens.

Welcome to the Delegates.

Mr. Dunlop, as President of the West Australian Chamber of Manufactures, welcomed the delegates from the agricultural societies throughout the State to the Conference. The manufacturers thought that during the annual produce show they might find time to attend the Conference, and talk over matters which were interesting alike to the producer and to the manufacturer.

Mr. J. L. Nanson, M.L.A., delivered the inaugural address.

Amongst the resolutions passed, the following are of particular interest to agriculturists :—

Names of Trees and Plants.

Mr. Park moved—"That, in the opinion of this Conference, it is desirable that all nurserymen and fruit-tree vendors be compelled under penalty to give a guarantee that all trees and plants supplied by them are true to name." He said that the matter was one of real importance to horticulturists. He had seen the same variety of trees sold under four different names. Honest nurserymen would not object to the enactment of such a provision. At present much worry and disappointment were caused to fruit-growers through the violation of the principle urged in the motion.

Mr. Phair said that the metropolis was fully in sympathy with the country delegates in the matter, and he seconded the motion.

Mr. Sanderson said the largest fruit-tree vendors in France and England would not give the guarantee which it was proposed to ask for. Where thousands of trees were concerned, it was impossible for the growers to do what was desired; but they undertook, if mistakes occurred, to endeavour to rectify them. The leading local nurserymen would, he believed, say they were opposed to the idea.

Mr. Park thought it would be found on inquiry that the local nurserymen would be in favour of the proposal. The grower would be protected, and good results would follow.

The motion was carried.

Agricultural Bank.

The Chairman said, as a matter of form, and to bring the question under the notice of the Government, he would move—"That, in the opinion of this Conference, the Agricultural Bank be amended without unnecessary delay on the lines advised by the Select Committee appointed by Parliament to report thereon."

Mr. W. H. Lang seconded the motion, which was supported by several other members of the Conference.

Mr. Hayward, M.L.A., announced that a deputation had that morning waited upon the Minister for Lands with regard to the question, and had received a very favourable reception.

The motion, on being put to the meeting, was carried unanimously.

Railway Facilities.

Mr. Willis moved—"That, in the opinion of this Conference, the Government should provide better facilities for transit for producers, and, in districts where road material is not obtainable, light lines of railway should be constructed." He said that in respect of transit facilities, Wanneroo was situated in somewhat similar circumstances as Jandakot. The Government gave no assistance to the settlers in the direction of making roads. If the

settlers at Jandakot could obtain easy and cheap access to Fremantle, very beneficial results would ensue. In districts where road material was not available, light lines of railways should be constructed.

The motion was seconded by Mr. J. C. Anderson.

Mr. Park and Mr. H. Hocking supported the motion. The latter, referring to the proposal to introduce a service of motor cars, said that, to make this means of carrying produce to the market thoroughly effective, they would require good roads, which would entail a large expenditure. He thought it would be preferable to lay down light lines of railway.

Mr. Phair considered that no more useful work could be done by the Government than to build light lines of railways. This was one of the best encouragements that could be given to settlers.

The motion was carried.

Fruit-growing Industry.

Mr. Willis moved—"That rewards should be given by the Government for the destruction of birds injurious to the fruit-growing industry." They found in the Jandakot district that birds were causing an enormous amount of damage to orchards. He had been requested to bring the matter before the Conference. They knew the Government were very liberal in offering rewards for the destruction of insect pests, and he thought they might be approached and asked to come to their assistance in this respect.

Mr. Gell said that in districts which were troubled with these pests, a rate should be struck, and the Government should subsidise the amount collected, pound per pound. For years, at the annual Producers' Conference, they had urged the Government to assist them in some way in regard to the matter under discussion. In the Great Southern Railway district two-thirds of the fruit products had been destroyed by these pests. The Government had not seemed to grasp the importance of this question. In all the districts where these pests existed they had roads boards, and these bodies should be empowered to strike a rate as he had suggested.

Mr. Willis favoured the suggestion made by Mr. Gell.

Mr. Ecclestone said that fruit-growers in each district should create a fund themselves, and the Government should be asked to subsidise this amount. He did not think it would be fair to ask settlers who were not fruit-growers to pay the rate it was proposed to strike.

Mr. Whistler supported the principle advocated by the previous speaker.

The Chairman also agreed with the proposal made by Mr. Ecclestone. He thought, however, the terms of the motion were sufficient. It would then be for the Government to devise the best remedy. The form the legislation should take might be left over for a time.

Eventually a motion was carried in the following form :—" That, in the opinion of this Conference, a reward should be given by the Government for the destruction of birds injurious to the fruit-growing industry, and that any money collected for their extinction should be subsidised by the Government to the extent of £1 for £1."

Insect Pests.

Mr. Phair, on behalf of a South-West delegate, moved—" That, in the opinion of this Conference, the administration of the Insect Pests Amendment Act is deserving of grave censure."

Mr. Park seconded the motion. He said the inspectors should be thoroughly experienced, and he condemned a proposal that had been made to appoint honorary inspectors. Any expenditure by the State in competent inspection at the present time would be returned tenfold.

Mr. Gell could not support the motion in its present form, as it reflected on the administration of the Department of Agriculture. The fault was not with the department, but with the Government, owing to the niggardly sum they placed at the disposal of the department. He would deprecate any system of honorary inspection. They should recommend that the Government should make more generous provision for the payment of inspectors. There was no department in the whole of the Government service which met with so little sympathy as the Department of Agriculture.

Mr. Park said he had no desire to reflect in any way upon the Department of Agriculture.

Mr. Hocking remarked that the department was not provided with sufficient money to thoroughly carry out the work entrusted to them. If the agriculturists would unite in supporting the department, they would be able to bring effective pressure to bear on the Government. He thought that the agriculturists were not doing what they might do in meeting and passing resolutions, and so keeping questions to which they were vitally interested well before the public.

The motion having been withdrawn, Mr. Gell moved—" That this Conference strongly urge upon the Government the urgent need of sufficient money being placed at the disposal of the Department of Agriculture for the efficient inspection of the State under the Insect Pests Act, and to that end that the staff of salaried expert inspectors be increased as the requirements of the State demand; and we, as a Conference, deprecate the appointment of honorary inspectors."

Mr. Willis seconded the motion, which was carried unanimously.

FEEDING POULTRY.

A. Crawford.

Among the questions most frequently asked when I am lecturing on Poultry, is how much food should be given daily to fowls. This is rather difficult to reply to, for so much depends upon the breed and the surroundings; in some places the fowls can pick up nearly their whole living when running about, while in others they are entirely dependent on what is given to them. Then there is the difference in the habits: some breeds are good hunters, and extremely active, always on the go in quest of what they can pick up, and will wander far afield, while others will hang around the homestead or sit in the shade waiting for food to be thrown out, and even when neglected do not seem to have the sense to try and make a living for themselves. Then again, there is the matter of size to be taken into consideration: a Leghorn or Hamburg will not eat anything like as much as an Indian Game or Cochin, but if we take ordinary fowl of moderate size, the following ration would be about an average of their requirements:—For breakfast, from $3\frac{1}{2}$ to $4\frac{1}{2}$ ounces of soft food such as pollard, bran and pollard, pea meal bean meal, oatmeal, etc.; and for the evening meal from 2 to $2\frac{1}{2}$ ounces of grain; always remembering that it is better to rather underfeed than overfeed.

INSECT PESTS ACT.

MONTHLY REPORT.

Much of the inspectors' time has been taken up during the past month in visiting orchards and gardens in and around Perth, to enforce the picking and destroying of all fruit affected by the fruit fly.

As in former seasons, the Chinese gardeners who have fruit trees are found to be the principal culprits in allowing diseased fruit to remain on the trees and ground. The Chinese invariably gives more attention to his vegetables than fruit trees, and when the fruit fly attacks his fruit the Celestial, instead of fighting the pest, calmly allows it to take his fruit, thankful, no doubt, that it does not extend its ravages to his cabbages and cauliflowers, the fruit trees thus becoming of little or no value to him. The Chinese gardener will not exert himself to keep them free from disease. The fruit is allowed to fall to the ground and remain there until it rots,

instead of being gathered up and burned. When an inspector visits the place, the Chinese either assumes a most innocent air and refuses to understand a word the inspector says, or else is most profuse in his promises to carry out the necessary work. If the inspector can afford the time to stay and see the work done, well and good; if not, there is nothing surer than the next inspection will show a condition of affairs strongly suggestive of the fact that nothing at all has been done. In the case of a number of gardens in Perth affected with fruit fly, it is proposed to take action to have all fruit stripped off the trees, so that the reproduction of the pest may be checked.

Inspections have also been made of orchards along the South-Western line as far as Pinjarra, and the fruit fly reported in a small orchard some six miles from the latter place. When these isolated outbreaks occur, the question as to how the fly can have been conveyed to the locality is invariably asked, and the answer can usually be found in the interchange of second-hand fruit cases. Until growers set their faces resolutely against the use of second-hand fruit cases there can be little hope of confining the ravages of the fruit fly to those localities in which it at present exists.

In addition to the fruit affected by fruit fly caused to be destroyed in orchards and gardens, 72 cases offered for sale in auction rooms and shops have been seized and destroyed on account of disease.

A number of orchards in the Donnybrook and Bridgetown districts have been inspected during the past month, with the result that the San José scale was found in nine orchards on 250 trees. More than half of these trees have already been treated by fumigation and the same treatment prescribed in the case of the rest.

The importations of fruit for the past month show a considerable decrease, no doubt attributable to the large quantities of local fruit coming forward. The total importations during February amounted to only 3,341 cases, as against 7,078 cases during the previous month.

G. BUCHANAN,
Chief Inspector.

10th March, 1902.

DISTRIBUTION OF SEED.

A distribution of seeds raised at the Experimental Plots at Hamel will take place during this month. Any one desiring to have some of these seeds for trial should make immediate application to the Secretary of the Department of Agriculture, as the supply is limited.

FREMANTLE FRUIT SHEDS.

G. Buchanan.

As a great amount of interest has been manifested in the treatment of imported fruits at the ports since the amendment of the regulations admitting apples, pears, and other fruits formerly prohibited, a description of the sheds erected for the purpose of providing accomodation for the inspection and disinfection of fruit at Fremantle will no doubt be read with interest by fruitgrowers and others.

The new shed, a large galvanised iron building, has been erected close to the Customs sheds. Its dimensions are about 150 feet long and 50 feet wide. Inside the main building are built the fumigating and steaming chambers. Seven of the chambers are of a cubical capacity of 1,200ft. each, with one large chamber of double that size. Three of the smaller chambers are connected with a large boiler in the yard, so as to allow of their being filled with steam for the purpose of disinfecting cases. The cases are stacked in this chamber, the door closed, and the steam turned on. A high temperature is obtained in a very few minutes, so there is little chance of any enterprising grub emerging from the steam bath with sufficient vitality left to do any further damage, or to propagate its species. A line of rails connects the shed with the jetty and the river wharves, so that the fruit, on being discharged into trucks at the ship's side, is run direct to the shed, where it is immediately unloaded and stored. The floor of the shed being built at a level of about three feet from the ground there is no danger of the cases being dumped heavily on to the ground when unloading from the trucks ; the cases can simply be carried from the truck to any part of the building in which they are required to be stacked, and as there are three large doorways opening on to the railway line the fruit can be landed at any part of the building. In dealing with apples and pears the cases of fruit are placed in the chambers and fumigated before being opened and examined. This course is necessary as the codlin grub may sometimes be found crawling about on the outside of the cases. After the fruit has been subjected for an hour to the fumes of hydrocyanic acid gas, the vent which allows the gas to escape through the roof is opened, and the fruit is then ready for inspection. Each case of fruit is brought separately from the fumigating chamber and emptied on to a table with edges raised to prevent the fruit rolling off. An inspector is in charge of each table and examines the fruit as it is spread before him. Should any of the codlin grubs, or evidence of their having infested the fruit appear, the fruit is run back into the same case and the lot immediately taken to the incinerators and burned. If the fruit, however, is free from traces of codlin moth and San José scale it is run into a clean case, and is ready to be passed out in lots to suit the importer. While the inspector is only concerned in picking out diseased fruit, the importers and their employees always pick out such fruit as is decayed and unfit for market, thus saving the duty and inspection fees which are only charged on the quantity

of fruit delivered. The waste fruit picked out in this way is destroyed in the same way as diseased fruit, and this fact gives rise to a most erroneous idea of the quantity of fruit actually destroyed by the inspectors in the execution of their duty. During the year 1901 no less than 7,079 cases of fruit were so destroyed, as against 1,848 cases condemned by the inspectors.

The treatment of other kinds of fruits is somewhat different to that adopted in the case of apples and pears. Bananas, cherries, plums, and similar soft fruits are not subjected to fumigation unless the inspector can detect the presence of some injurious disease. These fruits are all picked over in the presence of an inspector so as to obviate the probability of any diseased fruit being admitted.

In dealing with citrus fruits, the cases are first opened and the fruit unwrapped and examined, and all fruits affected with injurious fungoid diseases, or scale insects that are not found in this State, are picked out and destroyed by burning. The clean fruit is then placed in fresh cases, which are stacked in the fumigating chamber, and are then subjected to the same treatment as apples and pears.

Every convenience is provided for the expeditious and thorough treatment of the fruit to be dealt with. In addition to this chamber for steaming cases already mentioned, there is a large tank containing a solution of caustic soda, which is always kept boiling, and in which small lots of cases, lids, etc., can be dipped. A storeroom is provided in which the chemicals used in the disinfecting process are kept, and there are also separate offices for the inspectors and importers, both of which have telephonic connections. A large loft runs the whole length of the building; in this are stored the cases which have been steamed and are ready to be used for packing fresh lots of fruit in.

The whole of the work at the sheds is under the direct supervision of Mr. E. Beatty, who has acted as chief inspector at Fremantle for nearly eight years, and is, therefore, thoroughly conversant with the work. With him are associated four additional inspectors, who work under his direction, and even this number has to be added to in the winter, when large consignments of fruit trees are coming to hand in addition to the shipments of fruit, which are usually heavy during the winter season. During the year 1901 78,174 cases of fruit, and 116,760 trees and plants, were received and treated at the Fremantle sheds.

The illustrations are from photos taken by Mr. G. C. Baker, of the Department of Agriculture, and explain themselves.

The following is taken from the Adelaide *Garden and Field*:—

According to promise, I am sending you a few notes relating to the manner in which fruit is dealt with at the disinfecting stores at Fremantle, West Australia. These stores are very commodious, and capable of dealing with many thousands of cases of fruit. All the buildings and accessories are new and on an extensive scale, and I think I had better take the matter in detail, to be thoroughly understood.

As the fruit is landed it is placed on trucks and taken direct to the stores, the lines running up to the stores' platform. In landing and transferring, as is customary among lumpers, etc., the fruit cases are subjected to

treatment not at all gentle, but on arrival at the depôt all ordinary care is exercised. All apples and pears are placed in air-tight rooms and thoroughly fumigated previous to opening. There are five rooms devoted to fumigating alone. When this operation is performed they are opened in the presence of the importer, if he cares to be present.

This part of the business is quite fair. Should any single fruit be detected with a sign of codlin moth the whole case is rejected and burnt, case included. Many cases are rejected though the fruits are without blemish, because, by being stored in the vessel beside infected ones, have become contaminated. Hence I have seen fruit rejected which we could swear was perfectly free from the moth when shipped, but the insects had travelled to the cases during transit. Only a week since a splendid sample of Bartlet pears was condemned on this account.

I may add that if any infected dutiable fruit is condemned the said duty is not charged. Plums are carefully looked over, and the cases dipped in a warm lye for a period of from five to seven minutes, and then steamed to pretty well cooking heat, branded, and the fruit restored to them. That is, if so desired. Two air-tight rooms are used for this purpose, the steam being introduced along the ceiling through perforated pipes.

Lemons and oranges come in from Europe by the thousand. These have the papers taken off and all are examined. Any decayed fruit is removed, and then the fruit is replaced in the cases and thoroughly fumigated for scale. I saw some splendid fruit unpacked, that looked as though it had not been off the trees a week, fresh, plump, thin skinned, and bright in colour, and I can guarantee good flavour from personal tests.

Plants are fumigated, but are not injured by the process, the material used not being injurious to vegetable life. The last appliance for the treatment consists of two large furnaces with grids. Here all refuse, paper, fruit that has been rejected, etc., are cremated, and after the arrival of some shipments the furnaces are kept pretty busy.

Taking all things into consideration, I do not think that a more complete arrangement could be readily found. I saw numbers of "Codlers" taken from a single case of South Australian fruit, some dozens at least, or enough to start West Australia fairly well for breeding purposes. I went fully prepared to find something quite different, and to unearth a few points very much detrimental to our export trade, but I saw nothing that anyone could complain of. The West Australian Government are conservative without doubt, but who can conscientiously blame them?

I would here state that, in my opinion, if they do not do something with regard to introducing potatoes and onions, they will as surely get the codlin moth as we in the eastern States are as sure not to get rid of it.

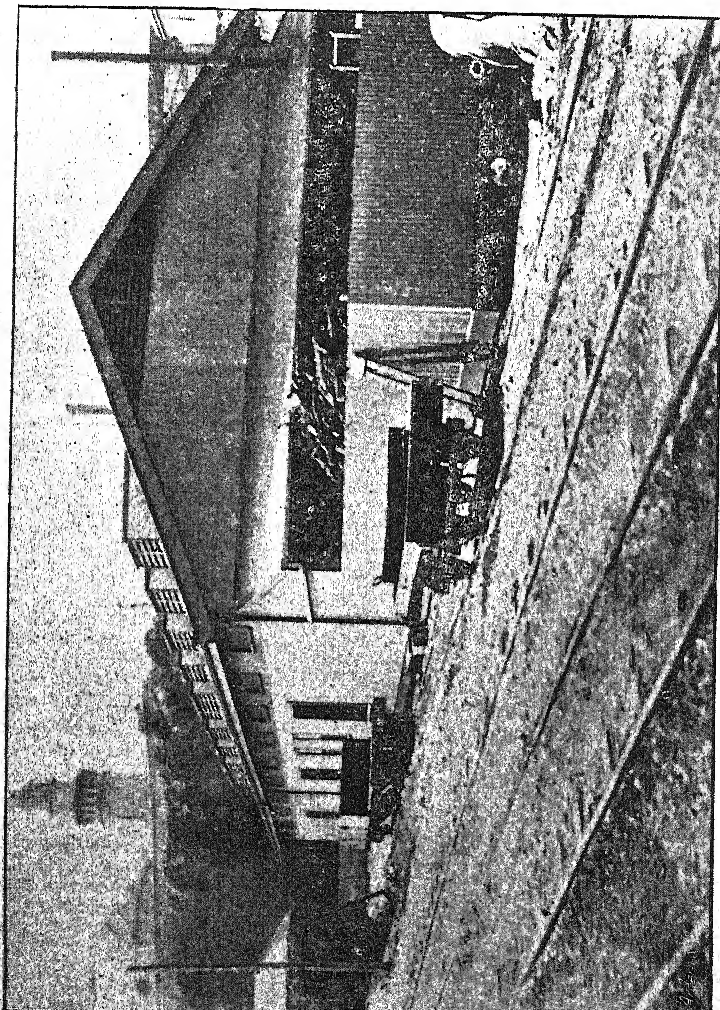
Many of the plums came out more like pulp than fruit, through being too loosely packed and a bit over-ripe Firm packing must be insisted on. At present, from what I know of the South Australian orchards and the fruit they contain, I have little hopes of seeing many cases survive the crucial tests they have to endure.

The West Australian-grown apples I have so far seen are only medium in quality. The grapes are fairly good, the tomatoes A1, and at present are 1d. per lb.

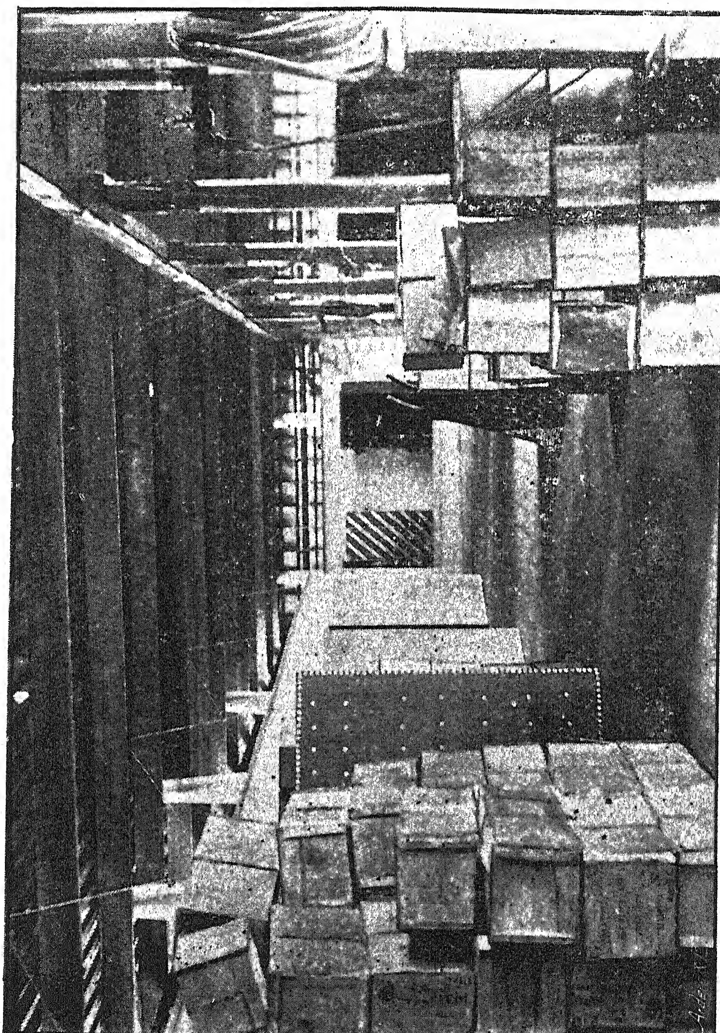
For the most part the price of fruit is far too high for the quality offered. Whilst at the Fruit Depôt I secured a few copies of the regulations, feeling assured that you would like to see them. During the coming week I hope to be able to give you a few notes respecting some of the gardens and orchards which I hear so much about. Of course I am expected to be thoroughly astounded with what I see, but time will tell, and I will be as fair and candid in my criticism as I have been over the depôt.

In conclusion, I would impress upon fruit-growers in the eastern States that Westralia has determined not to be the dumping ground for diseased or rubbishy fruit. She will absolutely destroy the former, and the

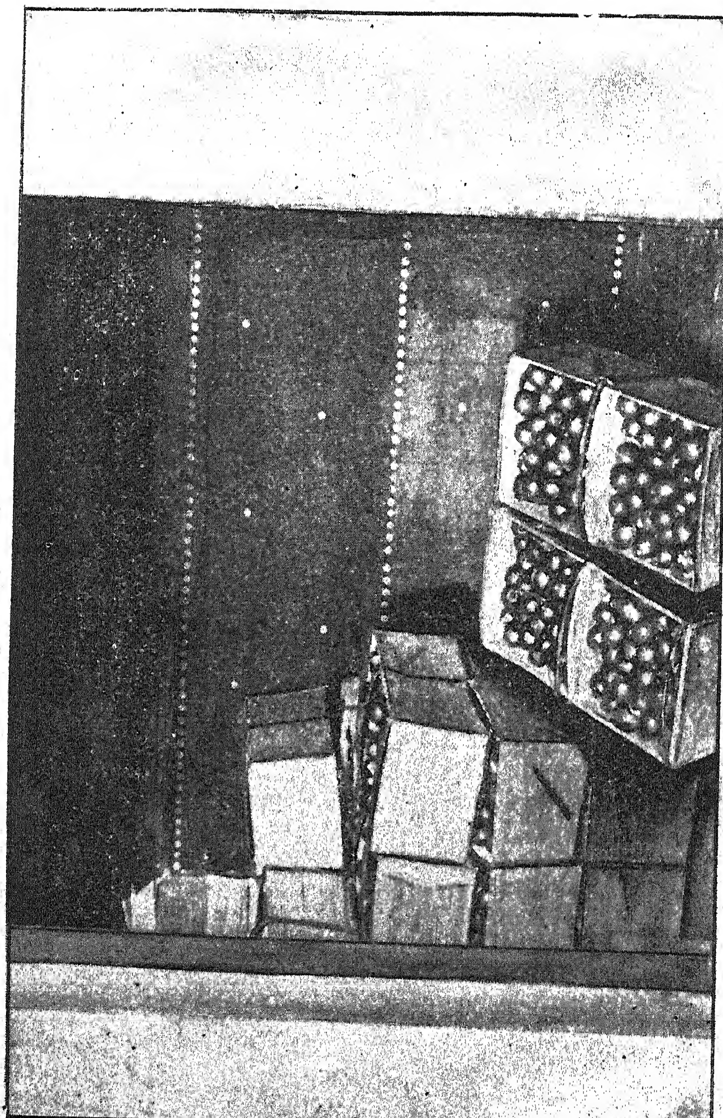
expenses of handling will make the other worthless. Only good stuff, most carefully packed, is worth sending. It is, I fear, impracticable, but it would be altogether a good thing if, in the interests of the careful packers, the Governments of South Australia, Victoria, Tasmania, and New South Wales could carefully inspect all fruit exported, to prevent any unscrupulous or, equally blameworthy, careless exporter from shipping stuff which will infest clean fruit on the voyage. I wish I could see a way in which it were practicable to do this, and make the careless or unscrupulous ones pay the expenses. With apples and pears it might be done, because urgency of despatch is so necessary with these fruits. In fact, they should in any case be repacked after being kept for a week or so, to allow of any codlin moth eggs or larvæ developing. At all events, a knowledge of the exact conditions of the trade will assist the exporter.



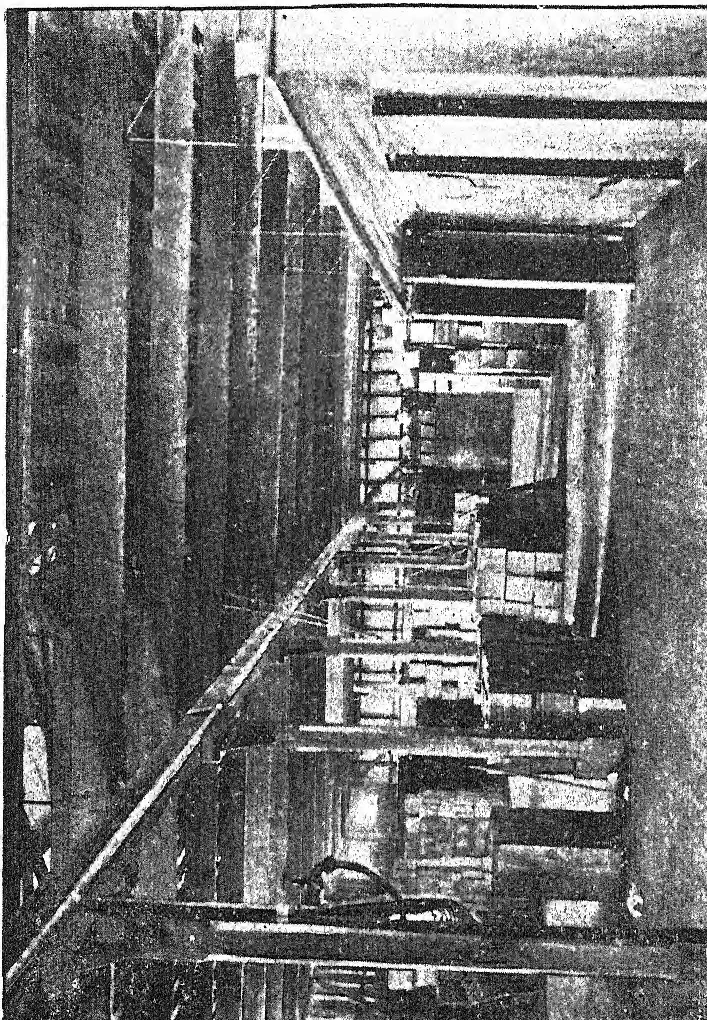
Fremantle Fruit Shed.



Inside view of Fremantle Fruit Shed, showing fumigating rooms.



Fremantle Fruit Shed. Inside of a fumigating room.



Inside view of Fremantle Fruit Shed.

INTRODUCTION OF PARASITES.

WHAT CALIFORNIA HAS DONE.

In a report made by Mr. Alex. Craw, Quarantine Officer, State Board of Horticulture, United States, to the Growers' Convention, California, he says, speaking of the work done by that State:—"The Hon. Teodoro Schneider, Commissioner of Chile, to the Pan-American Exposition at Buffalo, visited this State at the request of his Government and we furnished him, through the kindness of William Barry, of Niles, with strong colonies of *Rhizobius toowoombae*, and *R. ventralis*, which he took to Chile *viâ* New York. In order to check the destructive introduced pests of the fruit trees, you have sent two experts to Australia at different times to find the natural enemies of these pests, and to introduce them into California. One of the pests that the experts were especially requested to give close attention to was the "red scale" (*Aspidiotus auranti*). Australia and adjacent islands had been twice ransacked by Mr. Koebele and once by Mr. Compere. Several species of ladybirds that prey on this scale were collected and forwarded by them, but no true parasite was found in those countries. Mr. Compere was directed by you to visit also the Orient. At Hongkong he found evidences of internal parasites in the "red scale." He could find no suitable tree there to send to California, so in spite of the "Boxer" trouble in China he ventured into that country and succeeded in finding a small orange tree slighted infested, and on which he observed the small chalcid flies depositing their eggs in the scales. He purchased the tree, carefully dug and boxed it, and shipped it to San Francisco. In its native place the tree was overgrown with a dense crop of weeds that covered the stem for a foot or more. The portion so covered was badly infested with "red scale," as they were protected from the parasites by the weeds. The tree arrived in San Francisco on November 21, 1900, and was placed in a glass breeding-case. The scales hatched on the base of the stem and soon infested the upper portion of the tree and leaves. I did not expect that any parasites would appear before June, as most of the internal scale parasites generally issue about that time. On May 31 six parasites appeared, none in June, 36 in July, 81 in August, 143 in September, 381 in October, and up to November 29, 885, making a total of 1,532. These have been liberated in 'red scale' infested orchards in Los Angeles and Orange counties.

"Owing to our removing the parasites as soon as they are developed the scales are quite plentiful upon the imported tree. The parasites are hardly noticeable to the naked eye, as they are slightly smaller than *Aspidiotophagus citrinus*, the internal Japanese chalcid parasite of the 'yellow scale,' that has practically stamped

that former pest out of Los Angeles, Riverside, and San Bernardino counties. Professor Charles P. Lounsbury, of Cape Colony, is an enthusiastic believer in the value of beneficial insects, and on page 26 of his report as Government Entomologist for 1900, referring to the 'red scale,' which is also a pest with them, he says: 'The Californians have always believed that the scale originated in Australia, as they are confident that it reached their State from there; but now that they have had that land searched in vain for natural enemies, they may turn their attention to the South of Europe. We hope so.' This is a fervent wish, but our little chalcid friend has come from the other side of the world. An encouraging feature of these parasites is the fact that they prefer the scales before they have reached the stage where they reproduce their kind.

"With the exception of the cottony cushion scale, internal parasites have been the means of subduing or keeping in check most of our serious introduced scale insect pests, among which may be mentioned the following:

"The 'yellow,' by *Aspidiotophagus citrinus*; the 'soft brown,' by *Coccophagus lecani* and *Encyrtus flavus*; the 'brown apricot,' by *Comys fusca*; the 'San José,' by *Aphelinus fuscipennis*; the 'mealy bugs,' out of doors, by *Rileyia splendens*; the 'cottony grape scale,' by *Encyrtus flavus*."

[Mr. Compere is now under engagement with the Department of Agriculture of Western Australia, and is at present searching for parasites of our most troublesome scale pests.—Ed. *Journal*.]

CEREBRITIS OR "STAGGERS" IN HORSES.

The Kansas Experiment Station says that serious losses are occurring as a result of feeding wormy, mouldy corn, either when it is fed as a grain ration or when obtained by pasturing in the stalk fields, or when fed upon the cut corn fodder.

The disease is an inflammation of the brain or spinal cord and its coverings (meninges), associated with a breaking down of the nerve tissue of the brain. It is popularly called "staggers," or "mad staggers," because of the prominent symptoms shown.

Symptoms.—The symptoms are those of a brain disease. The animal appears blind and only partially conscious; there is often a tendency to turn in a circle to the right or left, and a staggering

or a straddling gait. There is usually a trembling of the muscles. As the disease progresses the animal becomes delirious and easily excitable. In many cases the animal will stand with the head or breast against a wall or manger and push. Animals will often eat when badly affected, apparently from force of habit, not because they are hungry. In some cases animals will die in a few hours after they are first noticed ailing. Most of them die within a few days; a few live a week, rarely longer. In a few cases the spinal cord is diseased, while the brain remains nearly normal. In these cases there is inability to control muscles, or the animal may be unusually sensitive, the least irritation of the skin, even by touching the animal, often causing it to kick violently. Where the spinal cord only is affected the animal frequently recovers. Laxative food should be given, and iodide of potash in one-drachm doses dissolved in water can be given once daily for three or four days.

Mules are rarely affected by this disease.

Treatment.—Practically all cases, where the brain is the seat of the disease, die, and all methods of treatment so far have proven of no value. The animal should be placed where it will be comfortable, and cannot injure itself or other animals, and supplied with soft laxative food, such as thin bran mashes. The only treatment for the disease is preventive, by avoiding the wormy, mouldy corn.

Care should be exercised in handling a horse to avoid injury, as the animal is irresponsible and often in a delirious frenzy.

In some cases horses do not begin to die for a month after being turned into the stalk fields, and they may contract the disease a week, and in some cases ten days, after the mouldy corn has been withheld.

Mouldy or wormy corn does not seem to be injurious to other animals, and can be fed to cattle and hogs without danger.—*The Pacific Rural Press.*

DAIRY PLANT.

The Department of Agriculture have for sale the following dairy utensils that are secondhand, but in good order:—One cherry concussion churn, 60lbs. capacity; one cherry butter worker, 35lbs. capacity; one Sharpel's hand separator, 25 gallons per hour capacity; and one milk aerator and cooler. Prices and full particulars on application to the Department.

THE MAN WITH THE HOE AND HIS FUTURE.

How Creative Genius will Lighten his Thraldom.

IMPORTANT HINTS FOR THE INVENTIVE. OPPORTUNITIES FOR FAME AND FORTUNE.

The following has been specially prepared for the *Farmer and Grazier* Show Number by Mr. G. G. Turri, probably the most capable expert in inventions and patents within the Commonwealth. His remarks being based upon long experience, keen judgment, and much inside information, will necessarily carry great weight.

Pathetic picture! sublime poem! world-famous indeed is the Man with the Hoe. Yet, before Millet, with his picture, and before Markham, with his poem, we may find it all in Genesis itself—all that makes us exclaim "poor devil" as we contemplate the incessant bondage of agricultural toil. Does not chapter III. of Genesis tell us that the first curse ever uttered related to the soil. I read: "And God said to Adam, cursed is the ground. . . . In the sweat of thy face shall thou eat bread. Therefore, God sent him forth to till the ground." But that curse, thank Heaven, is being lifted in spite of the ravages of droughts, and hot winds, and insect pests, fire, and floods. In spite of all these, the farmer, the most honest, perhaps, the most honourable of human beings, is being aided by the genius of invention to at last get the upper hand, and learn the way to secure rich harvests without having to struggle and sweat as generations of his ancestors were compelled so painfully to do. No one can go to an agricultural show without being struck by the marvellous extent to which invention has already entwined itself with the business of husbandry. We see there all these inventions together, cheek by jowl, many in actual motion for the instruction of the unaccustomed citizen. We feel gratified that with machinery we can make butter in one minute, plough an entire field in a day with a great multi-furrow implement that cheerfully jumps uninjured over any stumps it may meet, or reap and bind vast areas of grain in a few hours. On these things, or on the pumps and the windmills and the sheep shears, I will not dwell, but rather lay stress on the future inventions which lie ahead, the glorious certainty of whose coming has dawned upon us.

THE HORSE WILL GO.

The muscles of the man and his family, and of his horse and his ox too, are still strained to the utmost in using spade or plough, hoe or harrow, and churn, in orchard, farm, and dairy. It is all too exhausting, and electricity will quickly supersede it. Time was when the miner sweated too with pick and sledge hammer at the sullen rock, but now he can calmly smoke his pipe whilst holding

his drill in position, or putting in and firing his explosive. Electricity, or compressed air brought from a point sometimes miles away, not only saves his labour, but works faster and cheaper. Cheaply as horses can be fed, poor as is the pittance the farm labourer receives, long as are his hours—these barbarisms are doomed. Electricity will do most of the work, and the eight-hour principle, coupled with much higher and more reasonable wages, will yet leave the employer substantial profits and a healthier conscience.

Wind and Water Power.

As no one has yet found out how to make from fuel electricity as cheap as it should be, although the solver of the problem might easily sell his patents for ten millions sterling, the use of the winds, waterfalls, and tides of the world for generating electric power is becoming more and more extensive. Wherever a swift or large river, a turbulent sea, a large waterfall, or strong winds exist all the land for miles around can be supplied cheaply with all the needed power at low cost. Even where none of these things exist, back on those arid billiard tables, the sun-scorched plains of Australia, where even the tiniest blade of grass refuses to grow and the sheep and cattle die like flies till whole populations are beggared, here the very cause of all the ruin—the sunshine—can be converted into a wonderfully regular and potent producer of cheap electricity, by the aid of which water can be pumped from points a hundred miles away, or raised from strata thousands of feet deep.

Sun Engines.

Indeed, the steady blaze of the fiery Australian sun should prove as great a natural asset as the falls of Niagara are proving in relation to the American manufacturing industries. The illimitable areas of good soil we have, that have always been useless for want of water, will then be irrigated and cultivated and enough wealth will be drawn from the soil to suffice to make every inhabitant prosperous.

The invention of the

Sun Engine

has begun. Already a system of mirrors has been fitted together with such movement that steam has been kept up in a small boiler and useful work done.

In what country should inventors and the Government strive more than in Australia to carry those results—those James-Watt-like beginnings on and on till the great plains are filled with smiling homesteads and sun engines are doing the work?

No Steam Ploughs, but Electric.

So enormous is the electric power that can travel along a thin wire no thicker than is used in many farm fences—so handy is the wire to erect or move about, that steam for ploughing is doomed.

Steam is all very well when used close to where it is made, but it would be too cumbersome and costly to carry a great distance in pipes liable to be cooled down by every fall of the air's temperature.

With the electric plough, all that would be needed would be to stretch a wire cable across the field and connect the plough, harrow, or any other implement to it by a shorter cable that could slide along and could be lengthened or shortened as required.

Electric Manure.

Only the other day an American farmer was detected in an action, which, had he consulted a patent agent in the first instance, might have been modified so as to have made him famous and wealthy, instead of leading him into trouble. He was actually manuring many acres of his ground by discharging the electric current into it, the distribution being effected by a network of wires. The electricity acted upon the elements of the soil, producing chemical changes which enriched it and caused his crops to grow finer than those of his neighbours. He did not pay for his electricity, however, and so the growth of his budding genius was, unfortunately, arrested.

However, our own inventors have now a chance to take the matter up. Electricity can, by its great heating power, also make manure, mainly from the atmosphere itself, as Sir William Crookes, the President of the British Association, pointed out in 1898, in the annual address. To do this, the nitrogen in the air must be fixed and converted into nitrates by combination with suitable substances. The manure we derive from animals and from refuse vegetation will become utterly insufficient and utterly obsolete when scientific manure-making has had the full attention of inventors. Scientific manure will be cheap, powerful, and clean. It is totally unnecessary that there should be any foul smell or appearance about it.

Microbe Factories.

The genuine magician of to-day is the chemist. He already performs many feats which the most devout believer in the Arabian Nights would admit surpass in wonder and desirability the achievements recorded in its pages. It has been found that butter and cheese of high, and butter and cheese of low quality, simply differ in this, that one is distinguished by the presence of more aristocratic kind of microbes than the other. So with tobacco—certainly with figs—and very likely vegetation at large. Your rank, wretched colonial cigar is of an honest leaf, handled with care and skill all through its history. Why does that lovely Havana made by some ignorant, careless, unbathed Cuban nigger—that Havana cigar whose puffs are dreams of Eastern bliss, and make one forget life's pains—why does it when grown there from the very same seed eclipse ours altogether? It is because the Cuban soil, or Cuban tobacco plants, are infested by some special microbe which Australia has not. The microbe gives the flavour, and it is in this minute respect that inventors are needed to produce the most approved and

delicious flavour in all kinds of Australian produce. Bacteria or microbes are also essentials in manuring; small quantities of certain kind of land from one place taken to another may have, it is said, an inoculating effect by introducing the microbe required.

Crop Rotation.

To-day in America the poorest lands give the biggest wheat yields. That is to say, scientific methods more than make up for natural deficiencies. Of course, 2000 years ago they had some science. They knew that by a rotation—turnips, barley, clover, wheat—the production of the soil could be continued when otherwise there would be barrenness and exhaustion, and we still find that rotation a good one.

Cost of Electric Manure.

Sir William Crookes estimates that nitrate of soda could be made electrically at Niagara Falls for £5 a ton. If one had to use steam to make the electricity it would be £26 a ton. The electricity heats the air (which must be kept moist in some suitable vessel) so enormously that the nitrogen and oxygen burn, leaving nitrate of ammonia, which can be easily mixed with soda.

The natural nitrate deposits which we get from Chili, and use as manure, cost, as a matter of fact, a good deal more than £5 a ton when imported.

Electric Irrigation.

Wet weather, rain, and storm is not, probably, the best way of providing moisture which animals and plants require. Give your sheep and horses plenty of water and reasonable bathing in a rainless country, and they will get on better than in a rainy region.

Artesian Wells.

Give your wheat plant and your fruit trees enough water at the right time by irrigation and spraying, and your results will exceed those where rains have been either too forcible, too abundant, or ill-timed.

For these reasons the plains of Australia are destined to become the granary of that large portion of both hemispheres which America is not best suited to supply. There is an illimitable ocean of underground water available, which can be adequately tapped only by multiplying our existing artesian wells a thousandfold. Here, too, is scope for invention and patenting in drilling such wells cheaply, and in all kinds of appliances for best handling the water when raised.

Electric pumping-plants on an enormous scale will certainly be required, and these will probably be State owned, a single plant operating a large number of wells miles apart. Nearly everything in the world to-day that is done by man is done upon a puny, paltry, pottering scale. Instead of one giant, or high-power engine, which

would be truly economical, he has a hundred little ones. He uses, for example, a hundred little locomotives, each with its own furnace and fuel, to carry people about on the Melbourne suburban railways, whereas, if he had one single central power house, he could make enough electric power to drive twice as many locomotives much more rapidly at no greater cost. Bigness is, of course, not everything; high pressure is as much, if not more. It is enormous pressure, and that alone, which enables our steamships to go so fast now-a-days, and which enables our gas burners to give such a great increase of illuminating power when coupled with the Welsbach light. Without high pressure or voltage, too, electricity could not be transmitted great distances at low cost.

Every Farmer his own Rain Maker.

In the future the farmer and squatter will have many windmills to every one in use now. The present ones are not at all of so cheap a type as would serve all purposes when used in combination with electricity, which would store up the wind power, furnish light and heat for the household, and drive the machinery now hand-driven in the kitchen, sewing-room, and workshop. Another use of windmills is to load breezes with moisture, and to throw to great distances spray upon fruit trees and other vegetation. If the reader has a windmill on the windward side of some growing land, let him connect to it some long perforated piping in such a way that he can, over a certain area, make "rain" at will.

Assuredly the pastoralist who will intelligently put a thousand or two into showing Australia what a gigantic tree or grain-sprinkler would do would deserve greater and more enduring honour at the hands of his fellowmen than he who might lay out twice as much in the more ordinary "worthy cause."

Tree Doctoring.

Many inventions will be thought out and patented for the keeping of trees in perfect health, and those who are masters of the subject will practice as tree doctors, just as veterinary doctors do. No one would be such an idiot as to be satisfied with unhealthy horses or diseased sheep, because it wouldn't pay. So, too, diseased vines, pest-infested fruit trees, and bad seed won't pay. Our Agricultural Departments are like schoolmasters doing all they can to teach their pupils—the farmers—such wisdom as the departments themselves possess, and the Press, amongst its good work, is exerting continually and intelligently its influence to increase the wisdom and energy of the departments. Under these circumstances, we find sometimes valuable prizes offered by the State for inventions which would be of national value; or we find the department importing and testing the latest American machine for doing something that is much wanted, but which private persons or municipalities are chary of risking money in being the first here to buy.

Gas Baths for Orchards.

To kill off insect pests the great thing is poisonous gas, like the gas of that cyanide which is so much employed to eat out and save the gold from pyrites. What will poison an animal won't hurt a plant, and as the gas can penetrate better than anything else just wherever the tiniest insect can squeeze itself, all that we need do is to put up a big tent, big enough to cover in a whole tree, and travel from tree to tree; or to cover in a whole row of trees at once, and then apply the gas. Here there is a great chance for inventors, for tree gassing-tents are in the crudeness of infancy. Then a little later, when all our trees are in perfect health, and perfectly nourished and protected from their insect destroyers, the fruit yields will show the most marvellous increase, and the finest products will be as available to the labourer's family as to the King's.

River and Wave Motors.

That moving water exerts immense power is by many already fully realised, so that when a factory, farm, or town is near the ocean's giant force, the problem of how to use the great energy going to waste becomes a prominent one. If we look at a steamer of, say, 10,000 tons weight, rising and falling three feet once in six seconds, we then see the sea exerting a force of about 20,000 horse-power, all of which is wasted. Probably, the inventor in this field will adopt a number of floats or buoys of, say, 100 tons weight apiece, and as they rise and fall they would be made to compress air, which, in turn, would rotate machinery, and become useful as stored-up electricity. Every little buoy weighing 100 tons each would be able to give 100 horse-power of force, if lifted by the waves only three feet every ten seconds, so that much as the value of a family of boys is appreciated by the farmer, his estimate is probably much too conservative.

There is something so wonderfully steady about the ocean swell that it is strange inventors have not devoted more energy to the solution of the matter. Where there are fairly high tides, as Lord Kelvin has pointed out, it may be more profitable, instead of farming a piece of shore land, to let the tides on it, and generate power from the water as it ebbed. If this be so, how very much more profitable the big waves of ocean ought to be.

The Squatter's Air-compressor.

Compressed air has a hundred and one uses as power, in regard to which it is greatly superior to and cheaper than water-power. Windmills could be made to compress air instead of pumping water, and the resulting energy would enable a squatter to shear all his sheep, drive his wagons, clean all his tanks, bale his wool, or even pump his water better than the ordinary windmill does it. No big water tanks would be needed.

Man v. Machine.

A good example is given by an able writer on inventions (George Sutherland, M.A.), to whom I am greatly indebted for material of the expensive folly of using muscle power when machine power will do. A powerful porter carrying goods will in one day do no more than can be done by using five ounces of coal with proper machinery. The man eats infinitely more than the coal costs, so that even if he were an unpaid slave, it would be wasteful to employ him. But when we come to natural power, we find that it can be got from waterfalls like Niagara and those of Switzerland, also from windmills, far more cheaply still, so that one can now buy at Niagara Falls a horse-power for a year—usable for the full time, day and night—for less money than will keep a horse (doing a tenth of the work) in shoes alone.

PRACTICAL POULTRY JOTTINGS.

Difficulty in Rearing Chickens.

Many poultry-breeders in a somewhat large way experience considerable difficulty in rearing their chickens. They find the mortality is pretty heavy, and that a good many of the survivors do not thrive nearly as well as they might expect. Often they get along fairly well for a time, then they seem to stop growing for a good bit, and when they do arrive at maturity they are not the well-grown, handsome specimens which they should be. Of course there are a number of reasons which might very well account for this state of things, but one of the very commonest, and one which is hardly ever thought of, is that the chickens are reared on the same patch of ground year after year, and which is over-run by the old fowls when the breeding season is past. The ground gets stale and sour; it is tenanted by millions of putrefactive germs which spring into a most vigorous existence during the warmer season of the year; the chickens often eating off this ground are easily invaded by these germs, and the result is seen in frequent deaths and general want of progress. There are thousands of chickens reared on such ground as this every year, and I should like those poultry-keepers who read these words to ask themselves if the ground which they mean to allot to their chickens next season is all that could be desired as far as freshness is concerned. If it is not, then let them make other arrangements if they want to rear fine big birds which will do their duty to the egg-basket in due course of time.

Avoid Staling the Ground.

Stale ground has been the curse of many a breeder, though frequently without being recognised. How to purify stale ground is, therefore, a question of importance to many. If it is possible to choose other land near by which has not been over-run by fowls, it is better to do so for at least one season. Farmers, for instance, can generally make some such arrangement, and it will often pay them well to do so. The great thing is to give the stale ground a thorough rest, dress it well with unslaked lime, and, after a few months, turn it over to the depth of 15in. Then sow some grass seed over it, and in a twelvemonth's time it should be pretty right. But if you want to have it absolutely purified, give it a rest for two years.

Purifying Confined Runs.

Confined runs can be purified much quicker. A good digging over once in two months or so answers the purpose well for a considerable time, but the time does arrive when this ceases to have the desired effect. It is then better to take the earth out to the depth of a foot, spread a layer of quicklime on the bottom, and fill up with perfectly fresh earth. This can be repeated as often as may be required, but if the birds are not kept too thick on the ground a dressing with fresh soil should last a fairly long time. It may be noted that the old soil is very valuable for gardening purposes, but should be rather thinly dressed over a garden plot, as its manurial value is very high.

Keep a Spare Run.

There should always be one spare run kept untenanted. It need not be, and is not likely to be, always the same run, but a spare run comes in very handy when room is limited. For one thing, it can always be the means of giving another run a rest, and it is often convenient for the temporary isolation of a bird or birds. In fact, it can be of occasional use for many purposes, and should be maintained when at all convenient.

The Breeding Cock.

A breeding cock should be a sturdy, vigorous specimen of his race. It is worth while expending some pains, and occasionally a bit of money, in securing such a bird. It should be remembered that if he is not up to the mark in any way he tinctures all his offspring with his defects. It is a far worse case than merely having a deficient hen in a pen. Therefore get a bird which shows no physical deformities, is well developed in all respects, and possesses those particular qualities which you want to see in his offspring. An undersized bird for his age will throw weedy offspring, so will one descended from unhealthy progenitors. A slow-moving listless bird is of little value as a breeder, so is a greedy bird, one which thrashes his hens at feeding time. On the other hand, one

which chuckles to his mates and invites them to take the last peck without participating himself is too gallant by far, and will fail for want of that vigour engendered by a sufficient allowance of food. Such a bird should receive a special feed by himself at night. A breeding cock should show himself very active; when at liberty he should be continually leading his hens to "fresh fields and pastures new" in search of edible grub; he should be a frequent crower, and show his points well off. He should be firm on his legs, and well set up; if his legs are not well set on, if they are inclined to be shaky or become knock-kneed, he will never be a successful breeder. But with all these deficiencies absent, and all the foregoing good points well emphasised, he should be a credit to his pen.

Breeds which do not make Headway.

There are a few most excellent breeds which never seem to make any headway in this country, for the simple reason that their good qualities, sometimes even their very name, are unknown to the great majority of poultry-breeders; and that they are, and generally have been in the hands of only a few breeders in this country. A notable example of this kind is the Crève Cœur. Now, there is nothing really against the Crève at all. At one time it was supposed to be a soft fowl, but as a breed, this was not correct. It, indeed, possesses sufficient hardiness to lay very well in winter, and any breed which can number this among its characteristics is not entitled to be called soft. As a matter of fact, Crèves are very good layers, and they produce extra large eggs, too, quite as large as any that may be generally found. They are non-sitters also; very rarely does any specimen show signs of broodiness. They are large, square-built birds, short in leg and neck, lustrous black in plumage and crest, dark legs, long, deep breast bones, and quality and quantity of flesh of extra high order. A well-fed Crève makes a most substantial as well as a dainty dish on the table. Few breeds possess whiter flesh, or that of more deliciously juicy quality.

For crossing purposes, I like Crèves specially well. If it is table birds you want, then mate up with Dorking, Buff Orpington, or Indian Game hens, or half-bred hens of these varieties. Even barndoor mongrels of no particular parentage, if short on leg, square-bodied and long-keeled, will make very good all-round crosses with Crève Cœurs. Good all-round birds are produced when crossed with Langshan, Wyandotte, or Scotch Grey hens. The Crève is really worthy of a better cultivation.—R.G., in the *Farmer and Stockbreeder.*

THE WET EGG.

A correspondent, writing to the *Agricultural Gazette*, says:—"An egg when it is laid is a wet egg (the shell is wet), and the longer you can keep an egg wet the fresher it will remain. This is a truth, expounded, I believe, for the first time, and has never before appeared in print. Why do we hear so much, especially through the winter months, about bad and stale eggs? We know that hens, with all their faults, never lay stale eggs; we also know, to our cost, that but few hens during the winter lay any eggs at all, good or bad! Then where do we get our stale British eggs from? We stupidly make them stale by dry storing. If all British eggs were wet-stored the day they were laid, such a thing as a bad or even an indifferent egg would become a novelty, a curiosity, instead of being an everyday article of commerce. We all know that an egg becomes stale by keeping, but, let me add, by improper keeping. If an egg is kept a week it is far from fresh, if kept a month it becomes very stale, even objectionable; if kept three or four months it becomes what is termed 'the egg,' 'shop egg,' 'the foreigner,' 'not warranted,' or, to be more precise, the bad or rotten egg!

"We all know what dry storing is, when we look at a lot of eggs in a shop window or upon a shelf in the farmer's larder. Wet storing is the placing of eggs the day they are laid in glass water, and leaving them there until they are sold or required for immediate use. It matters not whether they have been wet stored a week, a month, or even five or six months, they continue equally fresh and always good alike. Surely this is a matter of some importance to the British farmer, the shopkeeper, and to every housekeeper? There is one way, and only one way, of forcing our farmers and shopkeepers to practice a little care and attention on the freshness of the eggs they supply. Let all housekeepers refuse to purchase British eggs from any shop unless they see them taken wet out of the preserving pan, and let all shopkeepers refuse to take in farmers' eggs except with a guarantee that they have all been wet-stored the day they were collected from the nests. There is no more trouble to wet store than to dry store, the only difference being placing the eggs in a dry box or basket in the one case, and into a bucket one-third filled with water glass in the other instance. Where, then, is the extra labour? Limewater has, for a century or more, been used in many private families as a preservative, but water glass is far better. The American and our own agricultural experimental farms and colleges have conclusively proved that glass-preserved eggs, even after six months' storing, were as nearly equal to a 'new laid' as a preserved egg can possibly be. Eggs kept in limewater after several months' immersion are apt to partake of a limey flavour and are only useful for kitchen purposes, but not for the egg-cup. I can speak personally as to the efficacy of water glass, for I have just finished two 9-gallon barrels of eggs, which I so preserved last

spring and summer. These eggs proved as sound and good as when I stored them nearly six months back; and, indeed, many of them, when the top was removed, retained within that 'milky' matter, so characteristic of an egg taken straight from the nest.

"All foreign and imported eggs are of necessity more or less stale and of uncertain age, having been laid weeks, and sometimes months, before they reach our markets. But the foreigner is more alive to his own interests than we are, and already they are beginning to practice the wet storing in water glass, and, unless we mend our ways, the day is not far distant when the stale, dry-stored egg will become the speciality of the British farmer and shopkeeper. It took twenty years before our farmers could be induced to adopt, even here and there, the Dutch factory system, to secure a good butter of uniform quality; how many years will it take us before we shall trouble ourselves to preserve the freshness of our eggs? As water glass is now an article of commerce, and quite cheap, let us hope that a jar of it may soon become a fixture in the larder or storeroom of all householders in town and country who can appreciate a fresh egg in preference to a more or less stale or bad one."

MARKET REPORT.

For Month ending 10th March, 1902.

Messrs. A. L. Ballantyne & Co., Produce Merchants and Commission Agents, City Markets, Perth, report sales in undermentioned lines for the month ending 10th March, 1902.

Farm Produce.—Chaff—The market has been fully supplied and shows a decidedly easier tendency. Prime green quality realised £3 17s. 6d. to £4 5s. per ton. Inferior and medium quality is hard to move at £3 to £3 10s. per ton. Oats—Market firm; prime Algerian 3s. 8d. to 3s. 9d. per bushel. New Zealand and Tasmanian 4s. to 4s. 2d. per bushel. Maize, 4s. 8d. to 4s. 9d. per bushel. Barley, 4s. 6d. per bushel. Peas, 5s. 6d. to 6s. per bushel. Bran, market firm, £7 2s. 6d. to £7 5s. per ton. Pollard, £7 5s. per ton. Wheat, truck lots, 4s. 1d. to 4s. 2d. per bushel; smaller lots, 4s. 4d. to 4s. 5d. per bushel. Potatoes—Imported arriving in large quantities, new quality, satisfactory prices, £8 to £8 10s. per ton; prime local, £9 to £10 2s. 6d. per ton. Onions in good demand, £7 10s. per ton. Flour, prime local, £9 10s. per ton. Imported flour, £10 5s. per ton. Seed potatoes slow of sale, 8s. to 10s. per cwt.

Dairy Produce.—Local butter scarce, 1s. 3d. to 1s. 5d. per lb. Imported butter much firmer, 1s. 1½d. to 1s. 3½d. per lb. Pastry butter, 1s. 1d. per lb. Cheese—New Zealand, large size, 9½d. per lb.; loaf size, 10d. per lb. Bacon, good demand for best quality, 11d. to 11½d. per lb. Hams, 1s. to 1s. 2d. per lb., according to brand. Eggs, local supplies becoming short, price 2s. to 2s. 3d. per dozen. Imported eggs, 1s. 5d. per dozen. Honey, 12s. 6d. to 15s. per 60lb. tin.

Fruit.—Supplies becoming much shorter past week or two, especially grapes and apples; prices realised as follow:—Apples, table varieties, 10s. to 18s. per case. Cooking apples, 7s. 6d. to 8s. 6d. per case. Pears, Williams, 17s. to 19s. per case. Other varieties, 6s. to 14s. per case. Plums finished for season. Grapes, good demand for muscatels, 6s. to 9s. per case. Wine grapes, 2s. to 3s. per case. Peaches about finished; prime quality, 20s. to 21s. per case. Poor quality hard to move. Water melons, 2s. 6d. to 10s. per doz. Imported lemons, 8s. to 13s. per case. Imported oranges, 18s. to 20s. per case. Passion fruit, 6s. to 8s. per case.

Vegetables.—Cabbage very scarce, prime lines 9s. to 10s. per cwt. Pumpkins, 4s. to 6s. per cwt. Beans, 1½d. per lb. Tomatoes, 2s. 6d. to 5s. per case. Turnips, 2s. per doz. Carrots and parsnips, 1s. 6d. to 2s. per doz. Salads, 6d. to 9d. per doz. bunches.

Poultry.—Very few lines offering. Prime table fowls, 6s. 6d. to 7s. per pair. Chickens, 3s. to 5s. 6d. per pair. Hens, 5s. to 6s. per pair. Ducks, prime quality, 6s. 6d. per pair; inferior slow of sale, 4s. 6d. to 5s. 6d. per pair. Turkeys, 20s. to 24s. per pair. Hen turkeys, 10s. to 12s. per pair.

Live Stock and Carcase Meat.—Pigs—Prime porkers, 30s. to 33s. each. Forward stores, 22s. to 26s. each. Backward stores, 13s. to 20s. each. Chopping pigs, 60s. to 70s. each. Suckers, 6s. 6d. to 10s. each. Carcase pork, 6½d. to 6¾d. per lb.

Sundries.—Bran sacks, new, 4s. 2d. per doz. Bales, 4s. per doz.; second-hand, 2s. 9d. per doz. Cornsacks, new, 5s. 6d. to 5s. 8d. per doz.; second-hand, 3s. 6d. per doz. Victorian rabbits, 18s. 6d. per case. Victorian dripping, 40s. per cwt. Concentrated milk, imported, 26s. per 50lb. case.

P.S.—The West Australian Farmers' Co-operative Company, Ltd., which has been successfully floated, have taken over our business at valuation. Our monthly report will in future appear under the name of the above-named company.

GARDEN NOTES FOR MARCH.

By Percy G. Wicken.

Now that the worst of the hot weather is over, a start should be made to clean up the garden, preparatory to sowing fresh seeds as soon as the first of the wet weather sets in. Rake up all the rubbish, pull up all dried up and useless plants and stack together all that are moist, so that they will rot; they will soon decay and will come in later on for manure. If the heap smells offensive, it can be covered with a little dry earth, which will soon take away any smell. Every opportunity should now be taken advantage of to prepare the land for future sowing, as, when the weather becomes wet, you will not have the same opportunities as you have now. Do not be afraid to go too deep. If trenching can be carried out at least 2ft. deep, so much the better, but the subsoil need not be brought to the surface. If any drains are to be put in, now is the time, so that they can be filled in again before the rain. If the land is trenched, stable manure should be mixed with the soil, the whole depth broken up, and not merely on the surface; you want to

encourage the roots to go down. Keep the cultivators going in the orchard and on fallow land, so as to keep the surface well stirred. Harvest carefully and put away to dry any seeds that may be ripe. Dry all melon and pumpkin seeds, and be careful not to get the varieties mixed up.

Beans (French).—Except in a few of the warmer localities, this crop will be nearly over. In hot parts, where there is no danger of frost, a few rows may be sown.

Beans (Broad).—This vegetable likes a heavy clay loam soil, although it will grow and bear in most soils. It should not be sown before the end of the month, and the ground requires to be well broken up, and if poor apply plenty of stable manure. Do not apply nitrogenous manures. Bonedust, superphosphate, and potash are the manures which should be used. Sow in rows 3ft. apart and about 5 inches in the rows.

Beet (Red).—A few rows may be sown. Thin out the plants that are coming up from previous sowings.

Borecole or Kale.—This is a plant which some like as a vegetable, and others do not think it worth growing. Seed may be sown the same as cabbages, and plants put out. It yields a large amount of green stuff, which can be used for the table or for stock.

Cabbage.—Plenty of plants should be available from the seed beds, and they should be planted out as soon as the ground is moist enough. Plant in rows 3ft. apart and 2ft. in the rows.

Carrots.—Plant out a supply for the winter. The drills should be 18in. apart. The seed takes some time to come up, and the weeds want looking after.

Sweet Potatoes should now be ready to dig. They can be stored, and if kept in dry sand will keep good throughout the winter.

Tomatoes are getting scarce; destroy by burning or boiling all diseased fruits, to prevent the spread of disease.

Melons and Pumpkins.—Store away for future use all those that are sound, they will be useful later on; any dry shed will do to store them in.

Peas.—In the cooler districts, a few rows of peas may be sown. Work the ground well, and apply plenty of potash and manures.

Turnips.—Prepare as much land as you require for this crop, and as soon as the rain comes sow full crops. There are a great number of varieties to choose from in both white, yellow, and Swede varieties.

Farm.—Most of the wheat crop is now winnowed and either sold or stored away until an opportunity offers for disposal at a satisfactory figure. Chaff-cutting is about the principal operation going on at the present time. Every effort should be made to get the chaff cut before the winter, otherwise the stacks will require thatching or covering. The first operation is ploughing for the

next crop. Where the land is sufficiently soft, the ploughing should be done as soon as possible, so as to give the land an opportunity to sweeten before sowing. Where ploughing is not practical, the ploughs should be overhauled and the necessary parts for renewal obtained, so as to make an early start when the ground is sufficiently moist. Remember that in most cases it is the early-sown crops that give the best returns. Look out the seed drills and give them a clean up, ready to start operations when required. Wherever possible, a rotation of crops should be carried out, or the ground allowed to lie fallow every third, if not every second, season. Crops of Rape, Mustard, etc., may be sown for sheep feed, and Mangels, Turnips, or Sugar Beet for feeding stock.

THE CLIMATE OF WESTERN AUSTRALIA DURING FEBRUARY, 1902.

The principal features of the month were the mildness of the climate in the settled portions of the State, and the abundant rainfall throughout the interior. On the West coast, the summer, so far, has been exceptionally mild, though by no means phenomenally so. The mean maximum temperature at the Perth Gardens, 84·2, was 4°·5 below the average for previous years, but it was considerably lower in February, 1895 (82·9), and very nearly as low in 1887 and 1897. Even taking the average for January and February, both of which months have been delightfully cool, we find that it was less in 1887 and 1895, and nearly the same in 1889. During this summer, so far, there have been only 21 days on which the thermometer reached 90°, and only four on which 100° or over was recorded. On the goldfields also, although the figures were not so striking, the temperature has been lower than usual, abundant rains have fallen, and there has been a scarcity of thunder and severe duststorms.

During the early part of the month a particularly good specimen of the tropical storms passed across the interior, accompanied by severe storms on the North-West coast and heavy general rains inland. This storm is interesting, not only intrinsically, but historically, as it marks the first attempt to forecast general summer rains throughout the interior for several days ahead. On the morning of the 3rd heavy rain was reported in the extreme North, but the barometers were not specially low. Next day the rain extended down to nearly latitude 20°, and clouds stretched down to latitude 23°, whilst the winds throughout the State were setting into the East and South-East. The rain now commenced to travel slowly but steadily down the coast, the wind remaining in the East, and the storm centre keeping out to sea. On the morning of the

5th a storm-warning was sent to all Northern ports, and this was repeated on the 7th. On the evening of the 5th preliminary indications of general rains were notified to the goldfields Press, and this warning was gradually strengthened and emphasised day by day. By the 7th barometers were decidedly falling in the neighbourhood of Broome, and next morning a "low" of considerable energy was very plainly indicated out to sea in the neighbourhood of Condon.

The storm passed inland a little to the North of Cossack and Roebourne, and commenced to travel across to the goldfields, the lowest reading of the barometer (28·82) occurring at Cossack at 12·30 p.m. on the 9th. The willy willy was not so severe as some which have been experienced, but the wind blew with hurricane force, and a great deal of damage was done. On the morning of the 10th the weather map showed a well-defined "low" a little to the North of the Murchison fields. By next morning it had reached the head of the Great Australian Bight, and on the 12th was lying to the East of Melbourne.

The following table, at a few selected stations, shows the amount and period of the rainfall which accompanied its passage:—

TABLE.

Station.	Date.											
	1	2	3	4	5	6	7	8	9	10	11	12
Wyndham ...	10	149	90	8	49	11	105	...	...	...	6	...
Hall's Creek ...	...	229	17	28	75	54	2	...	...	...	49	10
Derby ...	...	...	35	66	18	104	198	105	15	...	...	...
Broome ...	30	8	110	27	40	150	160	402	27	25	...	...
La Grange Bay	7	2	44	266	155	30	69	171	60	5	...	...
Wallal ...	3	3	...	106	12	...	10	19	426	2	...	...
Condon ...	...	...	...	...	30	...	7	...	490	125	...	...
Nullagine ...	10	...	...	...	...	...	...	...	30	260	...	...
Cossack ...	...	...	...	...	...	...	...	30	...	520	...	...
Onslow ...	...	...	...	...	...	...	...	...	...	15	...	...
Carnarvon ...	...	...	...	...	...	...	...	...	...	5	...	...
Geraldton ...	...	...	...	...	...	...	...	...	...	5	...	...
Peak Hill ...	...	...	...	...	...	...	...	...	8	149	255	...
Cue	...	...	...	...	...	...	...	...	...	...	93	...
Yalgoo ...	...	...	...	...	...	...	...	...	...	5	110	...
Wiluna ...	...	...	...	...	...	...	...	...	...	20	3	1
Mt. Sir Samuel	...	...	...	...	...	...	...	...	...	2	80	...
Lawlers ...	...	...	...	...	...	...	...	...	...	...	66	7
Laverton ...	...	...	...	...	...	...	...	...	...	...	8	...
Menzies ...	...	...	...	...	...	...	...	...	...	...	308	...
Coolgardie ...	...	...	...	...	...	...	...	...	...	3	122	6
Norseman ...	...	...	...	...	...	...	...	...	...	8	249	12
Southern Cross	...	...	...	...	...	...	...	...	...	49	201	4
Bremer Bay ...	...	...	14	...	...	...	5	...	...	6	52	18
Esperance ...	...	...	...	...	...	...	...	8	...	1	145	65
Balladonia ...	...	...	...	...	...	...	...	...	...	...	120	41
Eyre	...	...	...	...	...	...	...	...	...	2	1	12

The wind throughout the State remained in the East and South-East whilst the storm centre was approaching, but the observers are gradually forming the habit of recording the direction from which the clouds are moving. On this occasion special instructions were wired a few days before the rain actually came to all observers throughout the tropics and interior to pay particular attention to this point. As the result, the fact was established that prior to the advent of rain the general direction of the cloud was from N.W. or N. This, of course, was expected, but it is satisfactory to have the fact demonstrated.

Another "low" passed from the tropics down through the interior to the South coast, between the 19th and 22nd. This was, however, a very mild affair, but its passage was undoubted, and it brought scattered thunderstorms to the goldfields.

The rainfall for the month was very light in West and South-West districts, and even below the very moderate amount which represents the mean for previous years. Throughout the tropics and interior, however, it was considerably in excess of the normal.

W. E. COOKE,
Government Astronomer.

The Observatory,
Perth, 5th March, 1902.

The Climate of Western Australia during February, 1902.

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					February, 1902.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
North-West and North Coast:															
Wyndham ...	29·755	29·762	29·927	29·693	95·2	78·7	87·0	103·1	73·8	98·3	79·1	120·0	64·0	815	1882
Derby	...	29·775	29·975	29·549	93·6	77·2	85·4	99·0	72·5	93·6	77·0	105·0	68·0	594	1421
Broome ...	29·743	29·769	29·969	29·400	89·6	77·2	83·4	101·0	72·5	91·0	77·7	101·5	67·0	1150	1665
Condon ...	29·800	29·772	29·985	29·299	93·1	73·3	83·2	101·2	69·8	93·4	77·5	113·0	70·0	817	1980
Cossack ...	29·798	29·744	29·993	28·820	94·3	74·6	84·4	108·1	62·0	97·1	78·2	115·0	64·0	545	1250
Onslow ...	29·801	29·802	29·974	29·491	97·9	74·4	86·2	114·0	68·4	97·2	74·0	123·0	60·0	25	297
Carnarvon ...	29·886	29·809	30·086	29·599	85·2	70·0	77·6	95·2	67·2	90·5	71·0	114·0	52·0	5	416
Hamelin Pool...	29·885	29·812	30·084	29·569	95·1	65·3	80·2	102·2	58·4	97·3	69·7	112·0	58·0	*Nil*	112
Geraldton ...	29·946	29·898	30·153	29·683	80·0	63·4	71·7	90·0	52·5	85·4	65·0	111·0	51·0	*Nil*	37
Inland:															
Hall's Creek ...	29·835	...	29·994	29·686	94·0	75·6	84·8	103·2	68·4	98·5	74·4	108·2	61·3	614	1313
Marble Bar ...	...	...	...	...	98·1	75·0	86·6	111·0	69·7	...	...	...	...	674	1103
Nullagine ...	29·800	...	29·965	29·567	96·6	73·2	84·9	106·8	66·0	100·0	75·1	113·5	66·0	308	1194
Peak Hill ...	29·844	...	30·030	29·507	92·0	69·4	80·7	102·0	60·3	97·3	74·6	111·8	60·4	373	1456
Wiluna ...	...	...	...	...	...	...	...	...	...	...	...	...	...	26	939
Cue	29·874	29·792	30·140	29·545	94·9	68·4	81·6	105·3	56·2	99·0	72·5	113·1	57·0	107	627
Yalgoo ...	29·880	29·803	30·175	29·626	92·7	64·7	78·7	107·4	54·0	97·6	69·9	112·0	56·0	115	340
Lawlers ...	29·876	29·830	30·162	29·584	91·8	67·2	79·5	104·1	53·1	94·8	71·3	113·9	51·8	79	594
Laverton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	11	496
Menzies ...	29·911	29·868	30·262	29·573	90·0	64·7	77·4	104·0	53·5	92·1	66·7	111·5	47·8	308	621
Kalgoorlie ...	29·960	29·902	30·318	29·707	88·4	60·9	74·6	103·5	52·7	90·6	64·3	112·0	48·2	152	350
Coolgardie ...	29·940	28·901	30·290	29·707	89·1	59·4	74·2	102·8	49·8	90·6	62·7	112·9	47·4	131	253
Southern Cross	29·912	29·884	30·288	29·765	90·5	58·8	74·6	109·0	51·0	92·2	62·4	110·9	46·6	105	210
Walebing ...	...	...	...	...	88·3	58·2	73·2	102·0	47·0	...	...	...	...	*Nil*	3
Northam ...	...	...	...	...	...	...	...	103·1	50·1	...	...	...	...	*Nil*	*Nil*
York	29·960	29·934	30·330	29·810	88·4	58·0	73·2	102·4	45·3	90·4	62·8	115·6	45·8	*Nil*	*Nil*
Guildford ...	...	...	...	...	85·7	58·0	71·8	100·0	42·0	...	...	...	...	15	16

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Climate of Western Australia during February, 1902—*continued.*

Locality.	Barometer (corrected and reduced to sea level). Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. February, 1902. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	* Average for previous Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Total Points since Jan 1.
South-West and South Coast:															
Perth Gardens	29·990	29·954	30·320	29·740	84·2	60·3	72·2	95·0	47·4	88·7	63·0	113·8	49·0	10	14
Perth Observatory	29·995	29·929	30·322	29·740	80·4	60·2	70·3	93·1	47·5	85·1	63·8	106·8	50·1	8	11
Fremantle ...	29·992	29·942	30·319	29·796	75·6	61·7	68·6	90·6	51·8	82·7	64·1	106·0	48·5	3	4
Rottnest ...	29·980	29·922	30·276	29·721	74·4	61·7	68·0	85·4	56·2	81·3	63·6	109·0	52·0	2	4
Mandurah ...	...	...	...	...	80·5	56·5	68·5	92·8	43·0	...	...	...	...	24	28
Wandering ...	...	...	...	...	84·1	52·1	68·1	96·0	37·0	...	...	...	...	16	16
Collie	...	...	...	...	82·0	50·0	66·0	...	...	...	...	...	...	27	29
Donnybrook ...	...	...	...	...	81·5	52·0	66·8	90·9	36·9	...	...	...	...	73	75
Bunbury ...	30·020	29·977	30·369	29·758	77·3	55·5	66·4	86·5	44·0	81·6	58·9	101·5	42·0	32	32
Busselton ...	...	...	...	...	79·2	52·6	65·9	87·0	43·0	...	...	...	...	6	10
Bridgetown ...	...	...	...	...	81·7	48·4	65·4	95·7	35·0	...	...	...	...	29	30
Karridale ...	30·030	29·993	30·386	29·763	73·6	55·3	64·4	81·5	45·5	76·8	57·1	105·5	41·1	65	88
Cape Leeuwin	30·010	29·969	30·367	29·655	72·6	61·1	66·8	77·6	57·8	73·5	62·6	103·8	54·8	40	69
Katanning ...	29·994	29·948	30·393	29·738	82·3	52·7	67·5	92·0	42·0	84·7	55·1	109·0	37·9	13	13
Albany ...	30·047	30·044	30·448	29·763	71·7	55·2	63·4	84·8	45·2	71·6	59·6	100·3	41·0	34	77
Breaksea ...	30·040	30·006	30·458	29·669	68·1	58·9	63·5	70·8	52·0	70·2	60·5	81·0	50·0	40	89
Esperance ...	30·006	30·022	30·378	29·611	75·4	59·4	67·4	101·4	52·0	77·6	69·2	113·0	44·0	219	288
Balladonia ...	29·949	...	30·280	29·709	83·5	57·7	70·6	102·0	50·5	...	...	...	...	181	386
Eyre	29·976	30·997	30·268	29·688	78·1	60·3	69·2	105·0	49·8	79·6	62·2	110·2	42·0	46	278

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Observatory, Perth,
5th March, 1902.

W. E. COOKE,
Government Astronomer.

RAINFALL for January, 1902 (completed as far as possible), and for February, 1902 (principally from Telegraphic Reports).

Stations.	January.		February.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
East Kimberley:				
Wyndham ...	1067	17	815	12
6-Mile	1648	17	1013	13
The Stud Station	...	...	...	...
Carlton	...	...	...	...
Denham	310	5	...	...
Rosewood Downs	...	...	...	...
Argyle Downs ...	...	...	...	...
Lisadell	...	...	...	...
Turkey Creek ...	850	13	1034	16
Plympton, St. Mary	425	...	...	...
Koojubrin ...	...	...	...	...
Hall's Creek ...	699	12	614	13
Flora Valley ...	...	...	...	...
Ruby Creek ...	...	...	...	...
Ruby Plains ...	...	...	...	...
Denison Downs...	661	...	...	...
West Kimberley:				
Obagama ...	1257	19	...	...
Derby	827	12	594	7
Yeeda	...	...	...	...
Liveringa ...	1130	8	...	...
Mt. Anderson ...	818	13	...	...
Leopold Downs...	...	...	...	...
Fitzroy Crossing	764	16	...	...
Fitzroy (C. Blythe)	...	...	...	...
Quanbun ...	...	...	...	...
Nookanbah ...	...	...	...	...
Broome	515	...	1150	...
Roebuck Downs	653	14	...	...
Thangoo	843	14	912	...
La Grange Bay...	912	17	1404	18
North-West:				
Wallal ...	1138	10	730	10
Condon	1163	...	817	...
De Grey River ...	917	15	...	...
Port Hedland ...	936	17	408	3
Boodarie ...	751	12	...	...
Yule River ...	1001	9	...	...
Warralong ...	835	12	...	...
Muccan	436	12	...	...
Ettrick	575	12	...	...
Mulgie	755	11	...	...
Eel Creek ...	563	12	...	...
Pilbarra	995	9	...	...
Coongon	666	8	...	...
North-West—*cont.*				
Warrawagine ...	...	...	...	...
Braeside... ...	...	...	...	...
Bamboo Creek ...	865	13	272	5
Marble Bar ...	429	14	674	4
Warrawoona ...	686	16	570	5
Corunna Downs...	460	12	...	...
Nullagine ...	886	...	308	...
Yandicoogina ...	...	...	...	...
Tambourah ...	...	...	...	...
Kerdiadary ...	...	...	...	...
Roy Hill... ...	330	12	...	...
Mosquito Creek	645	14	...	...
Mulga Downs ...	819	13	...	...
Woodstock ...	704	16	...	...
Mt. Florence ...	1015	17	...	...
Tambrey ...	1051	15	...	...
Millstream ...	745	12	...	...
Yandyarra ...	592	12	...	...
Mallina	701	14	...	...
Whim Creek ...	1016	14	704	...
Cooyapooya ...	852	11	...	...
Woodbrooke ...	792	9	...	...
Croydon	847	12	...	...
Balla Balla ...	829	12	616	3
Roebourne ...	532	11	511	3
Cossack	705	10	545	5
Fortescue ...	445	11	113	4
Mardie	411	7	...	...
Mt. Stewart ...	1175	7	...	...
Yarraloola ...	478	11	...	...
Chinginarra ...	500	...	...	...
Onslow	272	10	25	2
Peedamullah ...	707	12	...	...
Red Hill	824	8	...	...
Mt. Mortimer ...	...	...	...	...
Wogoola ...	717	...	...	...
Nanutarra ...	481	10	...	...
Yanrey	...	...	...	...
Point Cloates ...	387	6	...	...
Gascoyne:				
Winning Pool ...	535	8	44	2
Towara	455	12	...	...
Ullawarra ...	404	7	...	...
Maroonah ...	270	9	...	...
Thomas Police Station	...	...	...	...

RAINFALL—*continued.*

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.	Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
Gascoyne—*contd.*					Gascoyne—*contd.*				
Bangemall ...	...	...	...	...	Tuckanarra ...	642	9	110	2
Mt. Augustus ...	...	...	...	...	Coodardy ...	493	7	...	...
Minnie Creek ...	...	...	...	...	Cue	520	10	107	2
Yanyeareddy ...	404	10	...	...	Day Dawn ...	502	7	78	2
Williambury ...	182	7	...	...	Lake Austin ...	441	9	49	2
Wandagee ...	...	...	...	...	Lennonville ...	291	4	141	2
Bernier Island ...	189	4	...	...	Mt. Magnet ...	284	5	98	2
Boolathana ...	...	...	...	...	Warracoothara ...	414	2	...	...
Carnarvon ...	411	...	5	1	Challa	260	3	180	1
Cooralya	...	...	...	...	Youeragabbie ...	298	2	...	...
Doorawarrah ...	...	...	...	...	Murrum	309	5	...	...
Mungarra ...	...	...	...	...	Yalgoo	225	6	115	2
Clifton Downs ...	795	7	...	...	Gabyon	175	3	...	...
Dairy Creek ...	...	...	...	...	Gullewa	26	...	162	2
Mt. Clere ...	...	...	...	...					
Errivilla	640	15	...	...					
Dirk Hartog Island	18	2	1	1	South-West Division (Northern Part):				
Sharks Bay ...	22	2	...	...					
Kararang ...	10	3	...	...					
Meedo	620	5	...	...	Murchison House	44	2	...	...
Tamala	...	...	...	...	Mt. View ...	34	2	...	...
Wooramel ...	505	4	Nil	...	Yuin	128	3	...	...
Hamelin Pool ...	112	2	Nil	...	Northampton ...	Nil	...	18	1
Byro	790	8	...	...	Mt. Erin ...	51	1	64	1
Yarra Yarra ...	864	8	...	...	Oakabella ...	...	...	...	...
Berringarra ...	1050	9	...	...	Narra Tarra ...	...	...	...	...
Mt. Gould ...	749	11	...	...	Tibradden ...	100	1	...	...
Moorarie	...	...	...	...	Sand Springs ...	80	1	...	...
Peak Hill ...	1083	14	373	5	Mullewa	55	2	21	1
Horseshoe ...	875	13	...	...	Kockatea ...	11	2	54	2
Abbotts	799	13	230	2	Bootenal ...	33	2	...	...
Belele	...	...	...	...	Geraldton ...	37	3	...	...
Mileura	1131	7	...	...	Greenough ...	Nil	...	Nil	...
Milly Milly ...	840	6	...	...	Dongara ...	Nil	...	14	1
Manfred	697	9	...	...	Dongara (Pearse)	Nil	...	...	...
Meelya	341	6	...	...	Strawberry ...	...	...	...	...
Woogorong ...	511	6	147	2	Mingenew ...	Nil	...	18	2
Boolardy	603	5	...	...	Rothesay ...	17	2	265	2
Billabalong ...	187	5	...	...	Field's Find ...	...	...	...	...
Wooleane ...	400	5	137	2	Carnamah ...	84	1	105	2
Murgoo	280	7	164	3	Watheroo ...	Nil	...	1	1
Meeka	546	6	36	2	Dandaragan ...	Nil	...	Nil	...
Mt. Wittenoom ...	363	5	...	...	Moora	Nil	...	Nil	...
Nannine	838	12	146	2	Yatheroo ...	Nil	...	Nil	...
Star of the East ...	802	8	121	2	Walebing ...	3	1	Nil	...
Annean	691	10	...	...	New Norcia ...	Nil	...	Nil	...

RAINFALL—*continued.*

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
South-Western Division, Central (Coastal):				
Gingin	Nil	...	Nil	...
Belvoir	3	2	...	...
Mundaring ...	3	1	6	1
Guildford ...	1	1	15	2
Kalbyamba ...	Nil	...	9	2
Canning W't'r'w'ks	Nil	...	...	...
Perth Gardens ...	4	2	10	2
Perth Observatory	3	2	8	2
Subiaco	Nil	...	2	1
Claremont ...	2	1	9	2
Claremont (Richardson)	...	...	...	...
Fremantle ...	1	1	3	2
Rottnest	2	1	2	2
Armadale ...	8	1	...	...
Rockingham ...	10	1	4	1
Canning River ...	4	1	...	...
Jarrahdale ...	8	1	8	1
Mandurah ...	4	1	24	2
Pinjarra	3	1	20	2
Harvey	10	4	32	2
South-West, Central Part (Inland):				
Hatherley ...	Nil	...	...	...
Momberkine ...	Nil	...	...	...
Culham	2	1	3	1
Newcastle ...	Nil	...	Nil	...
Eumalga ...	Nil	...	Nil	...
Northam ...	Nil	...	Nil	...
Grass Valley ...	Nil	...	Nil	...
Meckering ...	...	...	...	...
Cunderdin ...	Nil	...	Nil	...
Doongin	Nil	...	3	2
Whitehaven ...	Nil	...	...	...
Sunset Hills ...	Nil	...	...	...
Cobham	Nil	...	1	1
York	Nil	...	Nil	...
Beverley ...	Nil	...	3	1
Barrington ...	...	...	...	...
Sunning Hill ...	Nil	...	...	...
Wandering ...	Nil	...	16	2
Pingelly ...	Nil	...	Nil	...
Marradong ...	Nil	...	16	2

Stations.	January. No. of points 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
South-West—*contd.*				
Bannister ...	Nil	...	...	...
Narrogin ...	Nil	...	8	1
Wickepin ...	Nil	...	...	...
South-West Division (Southern Part):				
Bunbury ...	Nil	32	3	...
Collie	2	1	27	1
Salvation Army Settlement	...	...	...	...
Glen Mervyn ...	5	3	13	2
Dardanup ...	Nil	...	54	2
Donnybrook ...	2	1	73	2
Boyanup ...	3	1	49	3
Busselton ...	4	4	6	3
Quindalup ...	...	...	...	...
Margaret River	1	1	60	2
Lower Blackwood	15	1	Nil	...
Karridale ...	23	8	65	6
Augusta ...	44	9	32	2
Cape Leeuwin ...	29	10	40	6
Biddellia ...	35	6	43	5
The Warren ...	37	4	66	3
Lake Muir ...	21	4	32	3
Mordalup ...	18	5	20	5
Deeside	10	2	19	3
Riverside ...	34	8	...	...
Balbarup ...	21	5	20	3
Wilgarup ...	2	2	22	2
Mandalup ...	...	...	...	...
Bridgetown ...	1	1	29	2
Greenbushes ...	7	1	22	1
Williams ...	1	1	1	1
Arthur	4	2	5	3
Darkan	Nil	...	...	...
Wagin	2	1	4	1
Glencove ...	2	2	...	...
Dyliabing ...	Nil	...	...	...
Katanning ...	Nil	...	13	...
Kojonup ...	1	1	6	1
Broomehill ...	5	1	10	1
Sunnyside ...	6	1	17	2
Woodyarrup ...	5	1	14	3
Cranbrook ...	Nil	...	6	1
Blackwattle ...	Nil	...	...	...
Mt. Barker ...	30	5	29	5
Kendenup ...	11	1	22	3

RAINFALL—*continued.*

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
SOUTH-WEST—*contd.*				
St. Werburgh's	37	5	...	...
Forest Hill ...	40	6	...	...
Denmark ...	115	4	...	...
Albany	43	8	34	6
Point King ...	59	5	19	4
Breaksea ...	49	9	40	4
Wattle Hill ...	...	...	...	...
Cape Riche ...	...	...	...	...
Pallinup ...	4	1	16	4
Bremer Bay ...	8	1	81	6
Jarramongup ...	39	3	...	...
EASTERN DIVISION:				
Lake Way ...	913	12	26	4
Mt. Sir Samuel ...	582	12	107	3
Lawlers	515	9	79	4
Leinster G.M. ...	662	11	...	...
Lake Darlôt ...	680	9	...	...
Diorite King ...	...	...	...	...
Sturt Meadows ...	342	7	...	...
Mt. Leonora ...	340	11	76	3
Mt. Malcolm ...	344	7	73	2
Mt. Morgans ...	306	8	136	3
Burtville ...	370	8	...	...
Laverton ...	485	10	11	2
Murrin Murrin ...	368	9	73	4
The Granites ..	450	8	125	3
Tampa	443	4	...	...
Niagara	467	5	135	2
Yerilla	437	10	121	4
Edjudina ...	286	3	...	...
Menzies	313	5	308	1
Mulline	282	3	...	...
Wangine ...	...	...	...	...
Waverley ...	168	4	288	3
Goongarrie ...	381	4	411	4
Mulwarrie ...	161	4	248	4
Kurawa	241	3	290	5
Dixie Gold Mine	194	3	...	...
Kurnalpi ...	431	4	254	4
Bulong	253	3	194	5
Kanowna ...	259	4	218	6
Kalgoorlie ...	198	5	152	4
Coolgardie ...	125	7	131	3
Burbanks P.O. ...	131	5	167	3

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
EASTERN—*contd.*				
Burbanks Birthday Gift	114	5	159	3
Woolubar ...	170	4	...	...
Widgiemooltha ...	142	4	183	3
50-Mile Tank ...	72	2	218	3
Norseman ...	74	4	291	4
Bulla Bulling ...	116	3	191	4
Woolgangie ...	45	3	141	2
Boorabbin ...	70	4	235	3
Karalee	55	4	...	...
Yellowdine ...	97	2	255	2
Southern Cross ...	105	3	254	3
Mt. Jackson ...	60	4	218	2
Bodallin ...	129	3	221	2
Burracoppin ...	11	2	...	...
Kellerberrin ...	Nil	...	20	2
Mangowine ...	39	2	...	...
Wattoning ...	...	...	...	...
EUCLA DIVISION:				
Ravensthorpe ...	25	4	75	3
Coconarup ...	22	6	...	...
Hopetoun ...	51	6	68	4
Fanny's Cove ...	25	2	...	...
Park Farm ...	59	4	...	...
Esperance ...	69	...	219	...
Gibson's Soak ...	108	2	...	...
30-Mile Condenser	157	2	...	...
Swan Lagoon ...	101	7	...	...
Grass Patch ...	166	6	234	4
Myrup	34	5	...	...
Lynburn ...	101	5	...	...
Boyatup... ...	159	4	...	..
Middle Island ...	...	...	...	...
Point Malcolm ...	140	8	...	...
Israelite Bay ...	115	4	182	3
Bulbinia ...	...	...	...	...
Frazer Range ...	167	3	...	...
Balladonia ...	205	...	181	...
Southern Hills ...	...	...	...	...
Eyre	232	9	46	7
Clifton Downs (Eucla)	120	3	...	...
Mundrabillia ...	110	7	...	...
Eucla	115	9	34	6

The Observatory, Perth,
5th March, 1902.

W. E. COOKE,
Government Astronomer.

Return of Fruit imported into Western Australia during February, 1902.

Name of Port.	No. of Consignments Inspected.	Total No. of Cases.	No. of Cases Passed.	No. of Cases Prohibited.	No. of Cases Destroyed.	No. of Cases of														
						Apples.	Apricots.	Bananas.	Cherries.	Gooseberries.	Lemons.	Peaches.	Oranges.	Passion Fruit.	Pears.	Plums.	Rhubarb.	Pomoloes.	Pines.	All other fruits.
Fremantle ...	57	3448	3173	275	275	147	...	96	...	...	412	1	517	7	497	1416	...	...	79	...
Albany	5	180	164	16	16	48	...	5	...	...	...	2	...	...	31	78	...	...	...	...
Geraldton ...	2	4	4	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	64	3632	3341	291	291	195	...	105	...	...	412	3	517	7	528	1494	...	...	79	...

Department of Agriculture,
7th March, 1902.

Return of Fruit Trees and Plants imported into Western Australia during February, 1902.

Name of Port.	No. of Consignments of Trees or Plants.	Total No. of Trees or Plants in such Consignments.	No. of Consignments passed.	Total No. of Trees or Plants in such Consignments.	No. of Consignments of Trees or Plants prohibited.	Total No. of Trees or Plants in such Consignments.	No. of Packages dipped.	No. of Trees. Ornamental and Pot Plants.	Almonds.	Apples.	Apricots.	Cherries.	Figs.	Lemons.	Limes.	Mulberries.	Oranges.	Peaches.	Pears.	Plums.	Small Fruits.	Vine Cuttings.	All other Trees.
Fremantle ...	3	674	3	674	...	...	3	674	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Albany ...	2	115	2	115	...	...	2	115	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Geraldton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...
Bunbury ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	5	789	5	789	...	...	5	789	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Department of Agriculture,
7th March, 1902.

By Authority: Wm. Alfred Watson, Government Printer, Perth.

JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA.

Vol. 5.—Part 4.

APRIL, 1902.

PERTH:
BY AUTHORITY: WM. ALFRED WATSON, GOVERNMENT PRINTER.

1902.

DIRECTOR OF AGRICULTURE.

The Cabinet has been pleased to appoint Mr. W. PATERSON, of the Agricultural Bank, Director of Agriculture. This will mean that for the future the Department of Agriculture will be responsible to the Minister instead of being under the Lands Department, as hitherto. Mr. Paterson, as Director of Agriculture, will control the Departments of Agriculture, Stock, Rabbits, and Agricultural Bank.

NOTES.

MANURE FOR LUCERNE.—When lucerne has been sown on poor land, or where it fails to yield satisfactory crops, give the land a good dressing of farmyard manure, and sow about 4cwt. of superphosphate of lime and 2cwt. of sulphate of potash per acre.

WHY THEY LIKE HEREFORDS.—An American stock-breeder, in the course of an article explaining "Why We Like Herefords," says:—We like the Herefords for the profits we have derived, as we are not in the business for fancy or fun. We like them for their great grazing and feeding qualities and for their uniformity in appearance, and we believe there is no other breed of beef cattle as prolific. In twenty years' breeding we have had but one bull and two cows returned to us that were known to be non-breeders, but we like them best of all for their early maturing propensity, there being no question in my mind as to their superiority in this respect. The Shorthorns, Angus, and other breeds will always have their advocates, but no other breed can be ready for the market at so little expense and as young as the Herefords. Last year, experiments in feeding at the Kansas Experiment Station, showed a gain in steers of 100 pounds for 750 pounds of corn, while Professor Henry reports the average in a number of experiments to be 100 pounds of gain for 1,000 pounds of grain fed to 1000-pound cattle.

CULTIVATION OF SUNFLOWERS.—The first year of the twentieth century closed with a curious sale, on the Baltic, of a cargo of sunflower seeds, which changed hands at £11 5s. per ton. Though a small trade has been done in sunflower seeds for close on 200 years, this transaction was the first in which a whole cargo—300 tons from Odessa—was dealt with. In Russia, where the cultivation of the sunflower and the manufacture of oil from its seed is conducted on a large scale, the Grandi Flora is the variety

grown. The species rises in a slender stalk of 5ft. high, producing one monster head, the average yield being as much as fifty bushels of seed to the acre. So rich is it in oil that that quantity of seed will yield fifty gallons of oil; while the refuse of the seed, after this quantity of oil has been expressed, weighs 1,500lbs. when made into cattle cakes. Few people in England who grow the sunflower for ornament have any idea of its usefulness. It is among neglected crops in which there is money, as is shown by the price paid a few days ago. Besides the seed, every other portion of the plant can be utilised. The leaves furnish an excellent fodder; while in Russia the stalks are prized as fuel, and their ashes, which contain 10 per cent. of potash, are readily sold to soapmakers. Naturally, in Russia the chief virtue of the sunflower lies in oil contained in its seed. The oil is of a clear, pale yellow colour, almost inodorous, and of an agreeable, mild taste, so that it is in great request as a table article. Why sunflowers are not cultivated on an extensive scale in England, it is difficult to say. Poultry and cattle like the seed either in its natural state or crushed and made into cakes. No plant produces such fine honey and wax; when the flower is in bloom the bees abound in it.

How to Stretch Barbed Wire.—When a fence of barbed wire is being put up it usually takes two men to do it, and as this means a serious loss of time we here give the description of a handy tool by means of which one man can stretch the wire without the least difficulty. The tool can be made by any blacksmith, and the way to go about it is as follows:—Take a stout piece of steel, about 1in. wide, and a little over half an inch thick, and let one end be forged after the fashion of a jemmy, but with claws similar to those found on hammers. To stretch a wire the claws are caught behind a barb in the wire, and the tool is plied round the post.

Locust Plague.—We do not remember (says the *Weekly Chronicle*) that we have informed our readers that during 1902 there may be expected a visitation of the seventeen-year locust. The visit is due this year, and is confidently expected by the bug men in charge of arrangements for their hospitable reception. Dr. L. O. Howard, head of the bug department of the United States Government, stated as follows in a recent interview:—"The fulfilment of these predictions of the entomologists are not at all surprising, whatever they may seem to the uninitiated, for we have known and calculated that there will be a locust plague in 1902, just as the astronomers know when we are to have an eclipse of the moon or the sun. The family of locusts—or, rather, cicada—are divided into periodical and non-periodical, the former having the thirteen and seventeen-year broods, according to their periodical appearance. In 1885, it will be remembered, the United States was visited by a perfect horde of the cicada, which we learned at that time was a junction of both the thirteen and seventeen-year broods. The

female in the beginning lays her eggs in slits or cracks, which she makes by means of a sawlike instrument, in the limbs of young nursery stock and trees. In a couple of weeks these eggs are hatched, and out of them come little insects, which appear like small ants. These 'ants' run swiftly along the limbs of the trees and then fall deliberately to the ground and burrow their way into the earth. It is here that the remarkable feature of the periodical cicada is apparent. These insects, when once in the ground, remain in their subterranean abodes for thirteen or seventeen years, according to the particular brood to which they belong. At the end of that time they emerge—thousands and even millions of them—and quickly swarm over the trees and shrubbery, when their shells part in the middle of the back, and out of the old covering comes the true cicada, or locust, as it is commonly called, although the word locust should apply more particularly to the grasshopper."

A Self-propelling Oil Engine for the Farm.—One of the latest inventions which is likely to have a permanent place on the farm is a Self-propelling Oil Engine. It is manufactured by Messrs. James B. Petter & Sons, Ltd., Nautilus Works, Yeovil. This machine is entirely new, and as such, merits particular attention. The engine is self-propelling, of 5 B.H.P., burning four pints of ordinary heavy paraffin oil per hour. The engine has a patent lampless ignition, and is fitted with compensating gear, and driven from both rear wheels. It has powerful brakes and forward and reversing motion, and can be started from cold in ten minutes. Afterwards it can be handled and steered by a lad. Although the intention of this engine is simply to propel itself about from place to place, it is quite powerful enough to haul, on suitable ground, loads up to two tons, and can be used to draw a plough, cultivator, binder, or other agricultural implement.

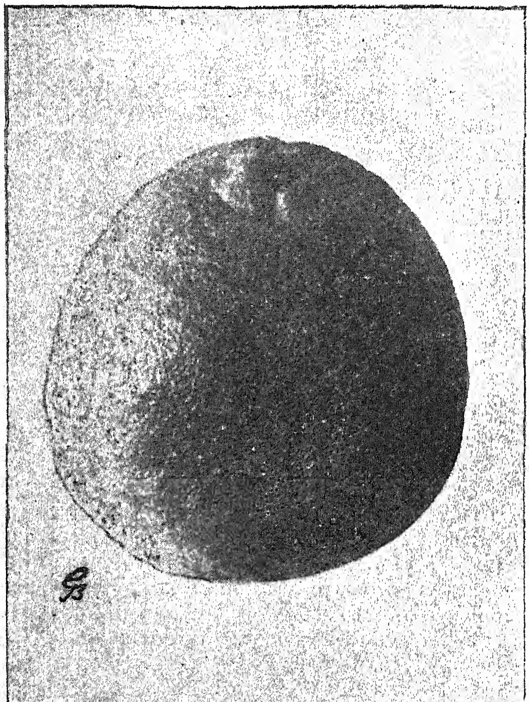
How Weeds are Spread.—The distribution of weed seeds is a subject of perennial interest. A "weed" is a plant which will grow under the most adverse circumstances and grow with most remarkable vigour in good soil. Some weed seeds appear to be able to live indefinitely in the soil without sprouting and finally start up in abundance. It is obvious that a single seed of such a plant introduced into a new country is sufficient to establish it there. Small quantities of seeds are distributed in ways which the unobserving are not likely to think of. Darwin found in the earth adhering to the feet of a plover three different kinds of seeds. In the mud sticking to the feet of ducks, shot in England, he detected seeds of plants peculiar to the Victoria Nyanza in Central Africa. In the soil clinging to the hoofs of a Texas steer the seeds of five different kinds of weeds and grasses common to Texas were found in New York. Bluejays, crows, and certain other birds are known to bury many kinds of seeds and nuts that subsequently take root and grow.

INDIAN ORANGES.

A. Despeissis.

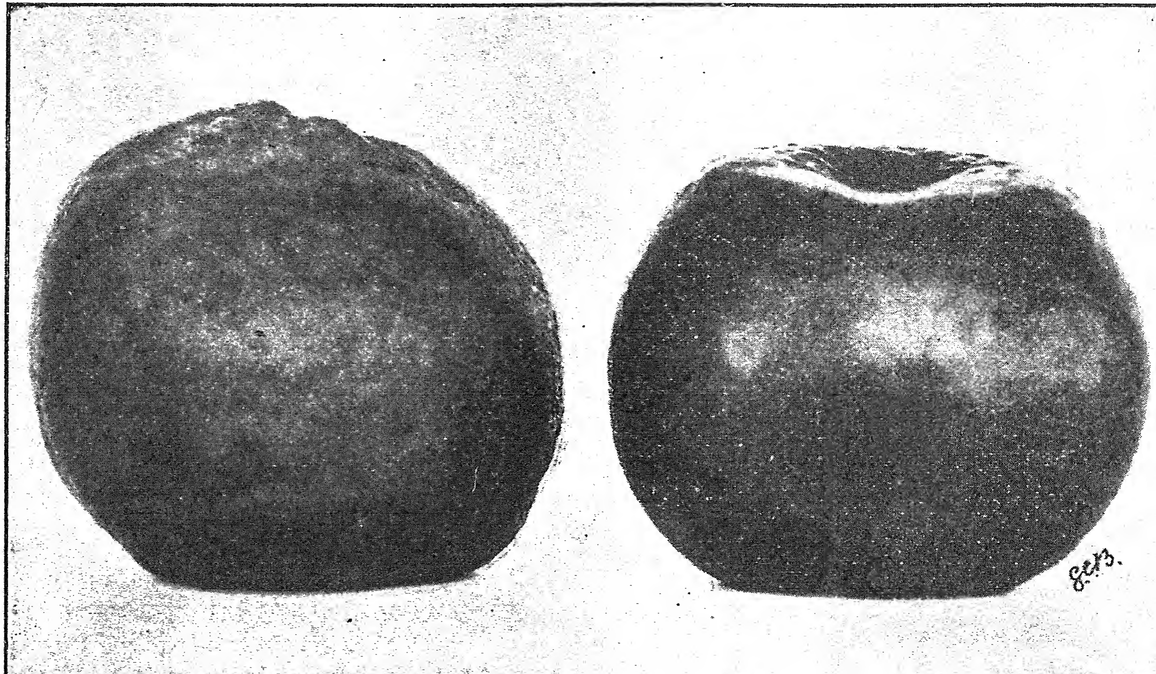
In response to inquiries made through the Superintendent Royal Botanic Garden, Calcutta, the Department received from the Superintendent Government Horticultural Garden, Nagpur, C.P., at the beginning of the year, a wardian case and a box containing a few plants and some oranges of the well known Nagpur variety.

The illustrations accompanying these notes are from photographs taken at the office of the Department by the Editor of the *Journal*, and show two Nagpur oranges and a Suntolah orange. A few notes about each of the varieties named will draw attention to their respective merits.



Suntolah Orange.

These oranges are of the Mandarine type, and are loose-skinned.



Nagpur Oranges.

The Nagpur Orange weighs 4 to $5\frac{1}{2}$oz., and measures, on an average, $2\frac{1}{2}$ to 3 inches in width by 2 to $2\frac{1}{2}$ inches in height. The fruit contains very few seeds, and some of the segments are seedless. It is a good carrier, one orange only out of eighteen having decayed during the journey from Central India to Bombay, thence to Colombo, and to Fremantle and Perth. The tree of this variety, which in other respects resembles the famous "Sylhet," is, however, of spreading habit; it is almost thornless.

The Suntolah Orange is also a Mandarine, and the fruit much resembles the preceding. It is a small but extremely sweet orange, which grows wild in the hot, humid part of India ranging between the foot of the Himalayas and the Ganges. Naturally, it requires very little attention. It is said to be sweet almost before it is quite yellow.

Whether these Mandarine oranges will prove as good or superior to the "Emperor" or to the "Beauty of Glen Retreat," both of which they resemble, it will not be possible to say until we have grown and fruited them. The "Suntolah" oranges, which, however, have the appearance of being good carriers, reached this Department in a state of hot fermentation on account of the unsuitable manner they were packed, being embedded in flock and loosely packed. Had they been simply wrapped in tissue paper and packed fairly tight in smaller cases, containing about 10 dozen or so, they would, I dare say, have stood the journey more satisfactorily.

A consignment of plants of this variety of oranges is announced to follow, and will be duly taken care of on arrival.

These Mandarines are yet new to Australia, and promise to add to our collection of valuable fruit.

THE SEASON'S FRUIT CROP.

Mr. A. Despeissis, the Horticultural and Viticultural Expert to the Department of Agriculture, speaking to a Press reporter with reference to this season's fruit crop, remarked that it had been one of the most successful we have had yet, and it was reasonable to think that the fruit crop would every year go on increasing in importance. The area under vines and fruit trees—which is now over 10,000 acres—has more than doubled within the last four years, and a number of young orchards and vineyards are now entering upon the productive stage. Grapes, apples, pears, and oranges have, of all other fruit, been the most extensively planted.

The Vintage.—As regards the grape crop, the present vintage has been highly satisfactory, both as to yield and, in most instances, as to quality. For 1901 the quantity of wine made was 130,000 gallons, whereas this year's estimate the amount was 180,000 gallons, showing an increase in one year of over one-third last year's yield, and three times the yield of the 1896 vintage, when the system of collecting agricultural statistics was initiated. Apart from the grapes turned into wine, a great many tons were disposed of by growers for eating.

Birds, especially silver-eyes and wattle birds, have also been responsible for more than the average amount of damage in localities surrounded with scrub and timber shelter, while "oïdium," which was singularly scarce all through the first part of the season, suddenly appeared during the cool, moist weather we had at the end of last year, and greatly reduced the prospective grape crop at many vineyards.

A notable acreage of our vineyards is yet unproductive, and with greater attention to the suppression of blights and to the manuring of the vines, the grape crop should show marked improvement every year.

The conversion of grapes into wine this vintage received at the hands of growers more consideration than it hitherto had. The thermometer and the saccharometer are not only now found in the fermenting shed, but they are also brought into constant use all through the fermentation of the grape juice. Record charts, specially printed for registering the progress of fermentation, are obtained on application; and considerable assistance has also been offered by the Department—and in many instances has been availed of by makers—in supplying from the Government Refrigerating Works one-cwt. blocks of ice, at a trifle over cost price, for the purpose of checking the tendency of large bodies of grape juice from unduly heating during fermentation.

The Fruit Crop.—Next to the grape crop, that of apples and pears have shown greater advance on the previous season's yield, and many observant orchardists estimate the increase at about four times that of last year, which, however, happened to be a disappointing one. I would state incidentally that to the best of our belief the codlin moth has not yet been detected in any of our orchards.

Stone fruit has not been so good this year, and the crop of peaches especially was at many orchards under the average.

The orange and lemon crops, which will within a few weeks be on the market, promise to be a larger one than any we have had yet, and it is expected that during the winter months the local market will be supplied mainly from our own orchards.

The Methods of Marketing, which are still often rough and primitive, have, however, greatly improved, and the fruit is reaching market in much better order.

The more careful growers are now grading, sorting, and packing their fruit with care and method, and their brands are in consequence getting known, and are looked for by distributors. A great dearth of packing cases has been experienced during the season, and fruit cases have risen to an exorbitant price.

The fruit case problem is one which deserves prompt attention, so as to guard against the same trouble next season. This Department is in communication with the New Zealand Department of Industries and Commerce to ascertain whether much of the waste timber now consumed at the Kauri timber mills could not be cut into suitable sizes for fruit cases, packed in shooks, and shipped to this market, where they would be speedily snapped at.

The American chip-wood punnets and crate boxes have now come to stay amongst our soft berry growers, and Canada, the United States, Sweden, Norway, and Japan are likely centres whence information on the possibilities of obtaining suitable fruit-cases is expected. Japan, by-the-bye, supplies many of the tea planters of Ceylon and India with the requisite tea chests. It was hoped that from our own timber land we would be able to draw the material suitable for case-making. Red gum, for instance, has for several years been utilised by some of the leading orchardists of the Blackwood for the purpose, and has only proved suitable for want of something better, the timber splitting unless it is sawn and nailed together when still green and sappy, in which case it is rather heavy. From the Warren district the Forestry Department procured at our own instance two varieties of timber—"the oak" (*Casuarina*) and a native timber of great promise, locally known as "beech," and which is in reality allied to our native coastal peppermint gum (*Agonis flexuosa*). They cannot, however, compare with soft wood for the purpose named. The "beech" agonis I thought would prove very suitable for making fermenting vats and wine casks, but it is often so full of borer-holes that the coopers who broke down the logs into staves express an opinion which is not as favourable as was expected for coopering work of any size. The wood is free from gum-veins, tough, and has much the texture of oak. The tests will be continued, and river banksia will also be tried. Wine casks as well as fruit-cases have been at a premium during the latter part of the summer, and the wine makers have experienced great difficulties in procuring suitable casks for storing their vintage. The trouble is, however, now over, but it is more than likely that past experience will weigh for little with our wine-makers, and that next season again will find many unprovided with storage casks.

A BENEFICIAL INSECT.

Cryptolæmus Montrouzieri, Muls.

A. Despeissis.

Another useful insect in the shape of a carnivorous beetle has just been introduced by the Department of Agriculture.

Last winter Mr. A. M. Lea, Government Entomologist of Tasmania, successfully introduced into Western Australia strong colonies of *Leis conformis*, a ladybird which ranks amongst the most useful in Australasia.* That ladybird, which was introduced without its natural parasites, is fast establishing itself in our gardens. The second beneficial insect referred to is a small beetle known to entomologists as *Cryptolæmus Montrouzieri.* That is one of the most formidable enemies of such soft scale-insects as the mealy bug (*Dactylopius*) *Pulvinaria* and various black scales. The larvæ of these predaceous beetles crawl about clad with a white mealy secretion in search of food and are also great scavengers.

Oranges infested by Mealy Bug.

* Journal of Department of Agriculture, Vol. IV., Pt. 3. Sept., 1901, p. 205.

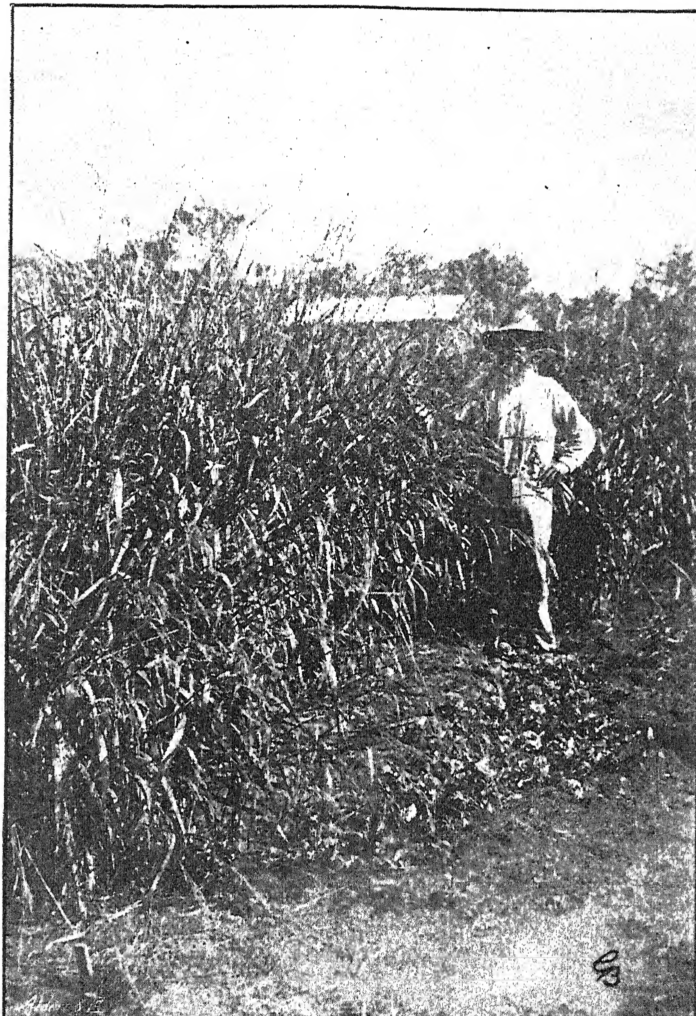


PLATE I.—Paspalum Virgatum grown at Hamel Experimental Plots.

The credit of this introduction is due to Mr. Geo. Compere, the Entomologist of this Department, now on a mission in the Eastern States of Australia, where he is collecting, for the benefit of this State, various useful predaceous insects and fruit pest parasites known to occur there. The consignment received from Mr. Compere contains larvæ, pupæ, and beetles of the *Cryptolæmus* ladybird. The beetles were liberated, on arrival, on orange trees and other plants infested with mealy bugs and the larvæ and pupæ placed in a breeding-jar until they reach the full-grown beetle stage when they are likewise liberated. "There will be no danger of secondary parasites with this species," writes Mr. Compere; indeed the species was itself fortuitously introduced in Australia, presumably from New Caledonia, and the introduction was in so far successful that it was effected without being accompanied by any of the insect's own parasites which prey upon it in its own habitat. This ladybird has firmly established itself in the Eastern States, more especially Queensland and New South Wales. In Queensland, says Mr. Tryon, it keeps in check the mealy bugs in the pineapple plantations, a pest which the same authority, on the testimony of Mr. C. Lounsbury, Entomologist of the Cape of Good Hope, has of recent years been accidentally introduced in the Cape Colony and caused the destruction of the pineries in the Eastern district of that colony.

The illustration here given is that of a bunch of oranges from a garden in Perth. The young fruit are seen covered with a fluffy white substance, which is the natural secretion of a mealy bug, which, until lately had not been known to attack citrous trees in this State. That the introduction of the natural enemy should have followed closely upon that of the pest is most fortunate. Its voracity and usefulness as a scale-destroyer have on several occasions been put to practical test. It was this particular *Cryptolæmus* ladybird which was introduced in Hawaii, where the *Pulvinaria psidii* was playing havoc with the coffee plantations, and in the same island too it reduced the orange mealy bug, which threatened to be as formidable a pest as it once was in Florida, to one of little or no account.

Owners of gardens infested by mealy bugs are invited to report the occurrence of the pest on their plants to the Department of Agriculture, when every effort shall be made to stock their gardens with the *Cryptolæmus Montrouzieri* ladybird.

EXPERIMENTAL NOTES.

PERCY G. WICKEN.

The accompanying illustrations are instructive, as showing some of the crops grown on the Experimental Farm at Hamel.

Paspalum Virgatum (Plate I.).—This photograph represents one season's growth of this splendid fodder grass. It grew over 9 feet in height by the end of December, and part was then cut down and in a few weeks had grown up to 3 feet high; the balance was saved for seed, which has been distributed to settlers all over the country. This grass is more upright in growth than the *P. dilitatum*, and will, I think, prove a heavier yielder in good soil. During the coming season I hope to try some roots in a drier district, and thereby test its value with other grasses, where there is a much lower rainfall.

Tree Tomato (Plate II.).—This plant takes more the form of a novelty than of general use. The tree shown in the illustration contains a large number of fruits, but I very much doubt whether the season at Hamel is sufficiently long to enable the fruit to ripen. At the present time the fruits are just changing colour, but are quite hard. It is a semi-tropical plant and ought to do well further North.

Hybrid Maize (Plate III.).—This is a crossbred maize; it was sown in October, and grew over 10ft. high, and yielded a large supply of green fodder. This maize makes a splendid green fodder for dairy cattle; and if more is grown than can be used green, it makes excellent ensilage, and can also be made into hay and makes a useful fodder. Making maize stalks into hay is almost unknown in this State, but is largely carried out in America, with very satisfactory results.

The Hon. the Minister for Lands has recently granted an extended area of 240 acres of land at Hamel for the purposes of an experimental farm. This land will be cleared and fenced by utilising the labour of good-conduct prisoners from the Fremantle gaol. (A view of the site of the prisoners' camp is given on Plate A.) A number of these have already started work, and are putting up some buildings to accommodate a larger number, and as soon as the buildings are completed a start will be made with the work of clearing the land; and it is hoped that some of this land will be available for sowing some summer crops in the spring of next season. The land is well watered and contains a variety of soil. The accompanying illustrations, taken a short time ago, give an idea of the timber on the ground previous to starting clearing operations. Block 10 (Plate IV.) is on the North side of the road,

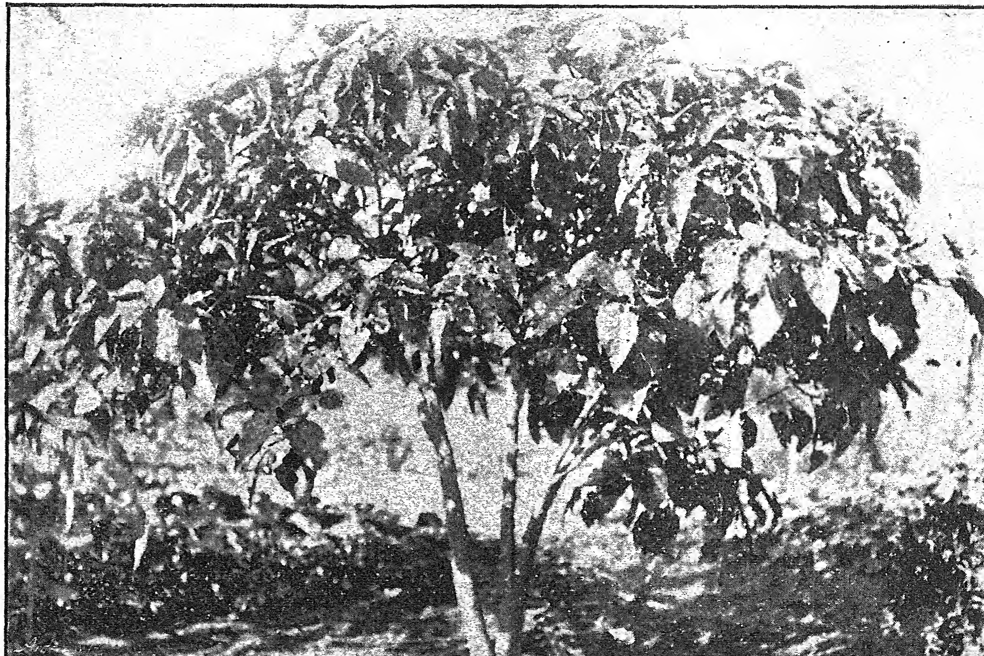


Plate II.—Tree Tomato. Grown at the Experimental Plot, Hamel.

and is thickly covered with blackboys, with an open channel running through it, in which the water has been running all through the summer.

Blocks 82 and 83 (Plates V. and VI.) show the dense growth of timber and shrubs on some of this land, about two miles from Hamel Siding, and also shows the creek running through the blocks. This is very good land, and should grow some splendid crops of maize, sorghum, etc., in the summer; and, after the drainage is attended to, should also be useful for growing good winter crops.

Blocks 9 and 11 (Plate VII.) are lightly timbered with small blackboys and shrubs. The soil is of a more clayey nature than that nearer the watercourses, and should be more suitable for growing wheat and cereal crops. A few open drains will be required to carry off the surplus water in the winter.

Block 30 (Plate VIII.) shows the land on the South side of the block, which is covered with a dense forest of banksia timber, and will take a considerable amount of labour for clearing. It is all good useful soil, and I hope to see it soon under cultivation. The land at Hamel is well watered and has a heavy rainfall, and the trouble there will be to get rid of the surplus water; but this is the trouble through most of the South-West districts. With the judicious expenditure of a reasonable amount of money and labour, this farm should become an object lesson to the settlers of the South-West district.

Narrogin Experimental Area.—In order to show what can be done in a drier district, the Hon. the Minister for Lands has approved of operations being at once started on this area. Ring-barking, clearing, and fencing will be immediately put in hand, and, if possible, an effort will be made to put in about 100 acres of wheat this season and to have a large area of land ready for cultivation by next season. A sum of money has been voted for this purpose, and the work will be carried out with all despatch. As soon as arrangements are sufficiently advanced, a number of stud stock will be kept on this area. The reserve at Narrogin contains a quantity of both first, second, and third class land, and has several patches of poison growing on it. It is well suited for an experimental farm, and is similar to large areas of land in the vicinity; the land is 1100 feet above sea level, and the rainfall is about 20 inches. The timber consists of jam, white gum, with a smaller quantity of red gum, jarrah, and sheoak. The bulk of the land is very suitable for wheat growing, and this will be the first crop sown.

INSECT PESTS ACT.

MONTHLY REPORT.

A considerable amount of work has been performed by the inspectors under the above Act during the past month. The supply of local fruit coming forward has continued heavy throughout the month, though soft fruits are now practically over. Local growers have been blessed with abundant crops this season, and prices having continued good, there is every reason to believe that fruit-growers in this State are enjoying a most prosperous season. The quantity of imported fruit to hand during March shows a further decline, only 3,035 cases being received at all ports for the month. Up to the present time apples, pears, and quinces have been shipped in very small quantities, the reason being probably the rather light crop in the Eastern States and the plentiful yield locally. The quantity of fruit condemned at the ports on account of disease during the past month amounted to only 29 cases, while 107 cases of decayed fruit were destroyed. The daily inspection of auction rooms and shops in Perth resulted in 134 cases of diseased fruit being seized and burnt, the bulk of the condemned fruit being affected with fruit fly, which continues to infest gardens in the vicinity of the metropolis. It is reported that the fruit fly has again made its appearance at York, and an inspector has been instructed to proceed there and take the necessary measures to secure its extermination from the orchard in which it has been reported. The fact of this pest appearing in localities that are—like the one just referred to—remote from known centres of contagion, emphasises the necessity for orchardists to be continually on the alert for the appearance of their foes, and I would here point out that Section 6 of the Insect Pests Act makes it compulsory for the occupier of any orchard to report the presence of any disease within twenty-four hours after first becoming aware of its existence among his fruit trees. If this clause of the Act were faithfully observed by fruit-growers it would enable the department to deal far more promptly with outbreaks of disease than is at present possible. It may be worth while to point out that the best means of dealing with the fruit fly is to prevent its propagation by keeping all ripe fruit picked daily, thereby preventing the maggots gaining access to the ground, where they breed. Fruit should never be allowed to remain and rot on the ground, even though there may be every reason to believe it free from injurious insects. Fruit that is unfit for market or home use should be gathered and cooked for fowls or pigs, thus disposing of all danger of the useless fruit serving as a harbour for noxious insects. To many fruit-growers details of this nature appear unimportant, but it is only by attention to every detail that the successful orchardist leaves his less thorough neighbour behind. It is probable that many fruit-growers in

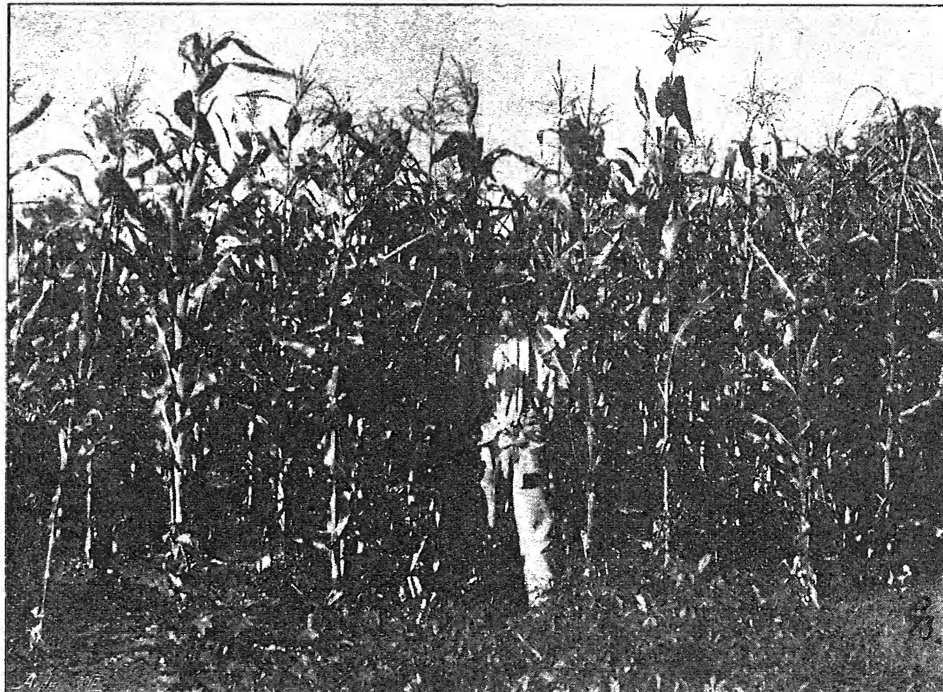


PLATE III.—Hybrid Maize. Grown at the Hamel Experimental Plot.

country districts, who are fortunately unfamiliar with the fruit fly pest, do not realise the amount of damage this insect is capable of doing, otherwise there would be no such thing as using second-hand cases, which is undoubtedly the means by which this pest is conveyed about the country. In Perth and the immediate neighbourhood, where this pest has obtained a thorough hold, it is probable that fully seventy per cent. of the fruit crop is damaged by this troublesome little insect. All who are interested in the fruit-growing industry should, therefore, spare no efforts to prevent this plague from obtaining a hold in their district, and wisdom will be shown in spending a little money in keeping this disease out of an orchard rather than suffering the loss it is certain to cause once it has established itself. During the past month over 100 orchards have been visited by the field inspectors, the principal districts being Blackwood, Donnybrook, Murray, and Swan. Of this number seven were found to be infested with San José scale, a total of 60 trees being affected. A few of these trees, being worthless, have been ordered to be destroyed, and the fumigation treatment prescribed for the remainder. Three orchards, in which this disease had formerly existed, were examined, and no trace of the scale could be found. In one of these orchards this disease had at one time obtained a big hold, but the fumigation of all the trees in the orchard has apparently resulted in the complete eradication of this pest, and it is worthy of notice that while these trees were subjected to a strong dose of hydrocyanic acid gas last winter, they have this season borne an abundant crop of high-class fruit, which is satisfactory evidence not only of the efficacy of the gas treatment as an insect destroyer, but also of its non-injurious effects on the trees operated on.

G. BUCHANAN,
Chief Inspector.

April 4, 1902.

THE FIGHT AGAINST SCALE.

The Work of Parasites in this and other Countries.

Professor L. O. Howard, in *Everybody's Magazine*: Some 25 years ago there appeared suddenly upon certain acacia trees at Menlo Park, California, a very destructive scale bug. It rapidly increased and spread from tree to tree, attacking apples, figs, pomegranates, quinces, and roses, and many other trees and plants, but seeming to prefer to all other food the beautiful orange and lemon trees which grew so luxuriantly on the Pacific Coast, and from which a large share of the income of so many fruit-growers is gained. This insect, which came to be known as the White Scale or Fluted Scale or the *Icerya*, from its scientific name, was an insignificant creature in itself, resembling a small bit of fluted white wax, a

little more that a quarter of an inch long. But when the scales had once taken possession of a tree they swarmed over it until the bark was hidden, they sucked the sap through their minute beaks until the plant became so feeble that the leaves and young fruit dropped off, a hideous black smut-fungus crept over the young twigs, and the weakened tree gradually died.

In this way orchard after orchard of oranges, worth $1,000 or more an acre, was utterly destroyed, and ruin stared many a fruit-grower in the face. This spread of the pest was gradual, extending through a series of years, and not until 1886 did it become so serious a matter as to attract national attention.

In this year an investigation was begun by the late Professor C. V. Riley, the Government Entomologist then connected with the Department of Agriculture at Washington. He sent two agents to California, both of whom immediately began to study the problem of remedies. In 1887 he visited California himself, and during that year published an elaborate report giving the results of the work up to that point. The complete life history of the insect had been worked out, and a number of washes had been discovered which could be applied to the trees in the form of a spray, and which would kill a large proportion of the pests at a comparatively small expense. But it was soon found that the average fruit-grower would not take the trouble to spray his trees, largely from the fact that he had experimented for some years with inferior washes and quack nostrums, and from lack of success had become disgusted with the whole idea of using liquid compounds. Something easier, something more radical was necessary in his disheartened condition.

Meantime after much sifting of evidence and much correspondence with naturalists in many parts of the world, Professor Riley had decided that the white scale was a native of Australia, and had been first brought over to California accidentally upon Australian plants. In the same way it was found to have reached South Africa and New Zealand, in both of which colonies it had greatly increased, and had become just such a pest as in California. In Australia, however, its native home, it did not seem to be abundant and was not known as a pest—a somewhat surprising state of affairs, which put the entomologist on the track of the results which proved of such great value to California. He reasoned that, in its native home, with the same food plants upon which it flourished abroad in such great abundance, it would undoubtedly do the same damage that it does in South Africa, New Zealand, and California, if there were not in Australia some natural enemy, probably some insect parasite or predatory beetle, which killed it off. It became, therefore, important to send a trained man to Australia to investigate this promising line.

After many difficulties in arranging preliminaries relating to the payment of expenses (in which finally the Department of State kindly assisted), one of Professor Riley's assistants, a young German, named Albert Koebele, who had been with him for a number of

Plate IV.—Block 10, showing drainage scheme.

Plate V.—Block 83, showing continuation of drainage scheme.

years, finally sailed for Australia in August, 1888. Koebele was a skilled collector and an admirable man for the purpose. He at once found that Professor Riley's supposition was correct; there existed in Australia small flies which laid their eggs in the white scales, and these eggs hatched into grubs which devoured the pests. He also found a remarkable little ladybird, a small reddish brown convex beetle, which breeds with marvellous rapidity, and which, with voracious appetite and at the same time with discriminating taste, devours scale after scale, but eats fluted scales only—does not attack other insects. This beneficial creature, now known as the Australian ladybird, or the *Vedalia*, Mr. Koebele at once began to collect in large numbers, together with several other insects found doing the same work. He packed many hundreds of living specimens of the ladybird, with plenty of food, in tin boxes, and had them placed on ice in the ice box of the steamer at Sydney; they were carried carefully to California, where they were liberated upon orange trees at Los Angeles.

The result more than justified the most sanguine expectations. The ladybirds reached Los Angeles alive, and, with appetites sharpened by their long ocean voyage, immediately fell upon the devoted scales, and devoured them one after another almost without rest. Their hunger temporarily satisfied, they began to lay eggs. These eggs hatched in a few days into active grub-like creatures—the larva of the beetles—and these grubs proved as voracious as their parents. They devoured the scales right and left, and in less than a month transformed once more into beetles.

And so the work of extermination went on. Each female beetle laid an average of 300 eggs, and each of these eggs hatched into a hungry larva. Supposing that one-half of these larva produced female beetles, a simple calculation will show that in six months a single ladybird became the ancestor of 75,000,000 of other ladybirds, each capable of destroying very many scale insects.

Is it any wonder, then, that the fluted scales soon began to disappear? Is it any wonder that orchard after orchard was entirely freed from the pest, until now over a large section of the State hardly an *Icerya* is to be found? And could a more striking illustration of the value of the study of insects possibly be instanced? In less than a year from the time when the first of these hungry Australians was liberated from his box in Los Angeles the orange trees were once more in bloom and were resuming their old-time verdure—the *Icerya* had become practically a thing of the past.

This wonderful success encouraged other efforts in the same direction. The State of California some years later sent the same entomologist, Koebele, to Australia to search for some insect enemy of the black scale, an insect which threatened the destruction of the extensive olive orchards of California. He found and successfully introduced another ladybird beetle, known as *Rhizobius ventralis*, a little dark-coloured creature which has thrived in the Californian climate, especially near the sea coast, and in the damp air of those regions has successfully held the black scale in check. It was found,

however, that back from the sea coast this insect did not seem to thrive with the same vigour, and the black scales held its own—in some places more than held its own. Then a spirited controversy sprung up among the olive-growers, those near the sea coast contending that *Rhizobius* was a perfect remedy for the scale, while those inland insisted that it was worthless.

A few years later it was discovered that this olive enemy in South Europe is killed by a little caterpillar, which burrows through scale after scale, eating their contents, and an effort was made to introduce the caterpillar into California, but these efforts failed. Within the past two years it has been found that a small parasite fly exists in South Africa which lays its eggs in this same black scale, and its grub-like lava eats out the bodies of the scale and destroys them. The climate of the region in which this parasite exists is dry through a large part of the year, and therefore this little parasitic fly, known as *Scutellista*, was thought to be the needed insect for the dry Californian regions. With the help of C. P. Lounsbery, the Government Entomologist of Cape Colony, living specimens of this fly were brought to this country and were colonised in the Santa Clara valley, near San José, California, where they have perpetuated themselves and destroyed many of the black scales, and promise to be most successful in their warfare against the injurious insect.

This same Scutellista parasite had, curiously enough, been previously introduced in an accidental manner into Italy, probably from India, and probably in scale insects living on ornamental plants brought from India. But in Italy it lives commonly in another scale insect, and with the assistance of the learned Italian, Professor Antonio Berlese, the writer made an unsuccessful attempt to introduce and establish it a year earlier in some of our Southern states, where it was hoped it would destroy certain injurious insects known as "Wax Scales."

In the meantime the United States, not content with keeping all the good things to herself, has spread the first ladybird imported—the *Vedalia*—to other countries. Four years ago the white scale was present in enormous numbers in orange groves on the left bank of the River Tagus, in Portugal, and threatened to wipe out the orange-growing industry in that country. The Californian people, in pursuance of a far-sighted policy, had, with great difficulty, owing to lack of food, kept alive some colonies of the beneficial beetle and specimens were sent to Portugal, which reached there alive and flourishing. They were tended for a short time, and then liberated in the orange groves, with precisely the same result as in California. In a few months the scale insects were almost entirely destroyed, and the Portuguese orange-growers saved from enormous loss.

The *Vedalia* was earlier sent to the people in Alexandria and Cairo, Eygpt, where a similar scale was damaging the fig trees and other valuable plants, and the result was again the same, the injurious insects were destroyed.

Plate VI.—Block 30, showing the heavy growth of scrub.

Plate VII.—Blocks 9 and 11.

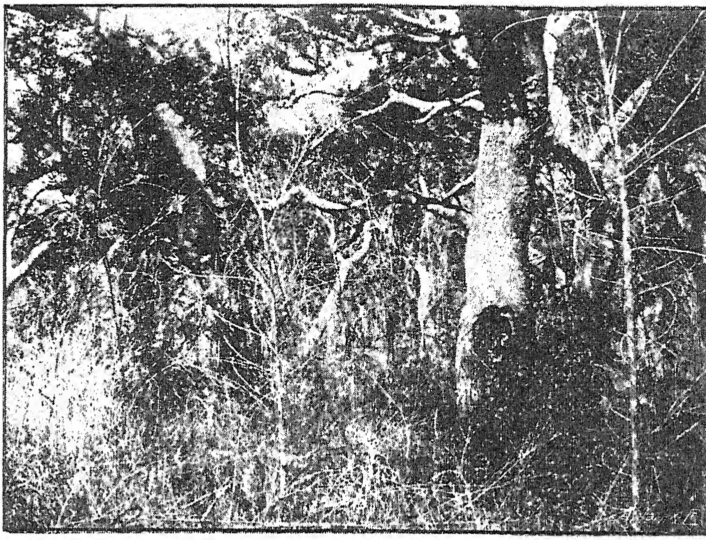


PLATE VIII.—Block 30, showing dense growth of Banksia

PLATE A.—Site selected for Prisoners' Camp, Hamel.

The same thing occurred when the California people sent this saviour of horticulture to South Africa, where the white scale had also made its appearance.

It is not only beneficial insects, however, which are being imported, but diseases of injurious insects. In South Africa the colonists suffer severely from swarms of migratory grasshoppers, which fly from the north and destroy their crops. They have discovered out there a fungus growth, which, under favourable conditions, kills off the grasshoppers in enormous numbers. At the Bacteriological Institute in Grahamstown, Natal, they have cultivated this fungus in culture tubes, and have carried it successfully through the whole year, and they have used it practically by distributing these culture tubes wherever swarms of grasshoppers settle and lay their eggs. The disease, once started in an army of young grasshoppers, soon reduces them to harmless numbers. The United States Government last year secured culture tubes of this disease, and experiments carried on in Colorado and in Mississippi show that the vitality of the fungus had not been destroyed by its long ocean voyage, and many grasshoppers were killed by its spread. During the past winter other cultures were brought over from Cape Colony, and the fungus is being propagated in the Department of Agriculture for distribution during the coming summer in parts of the country where grasshoppers may prove to be destructively abundant.—*Weekly Chronicle.*

SHEEP EATING OFF GRAPE VINES.

A correspondent writing to the Department asks:—"Is it in any way detrimental to grape vines to put sheep in to eat the leaves off at this time of the year?" The matter being referred to the H. and V. Expert, Mr. Despeissis, replies:—"Sheep are often folded in vineyards after the grape crop has come off. The practice may be detrimental to the vines if the leaves are still in that state of active vegetation when they are engaged in the work of converting liquid plant sap into fibrous tissues, and that store of food which the young shoots draw upon when first starting growth after their period of rest. Whenever the autumn leaves begin to fade and turn from green to yellow green, with a tinge of purple, they cease to be of much assistance in tissue building, and can then be fed off by sheep. At that stage the bundles of vessels which carry the sap circulation begin to wither up, and after a week or two the leaves drop off the nodes of their own accord, and are blown about by the wind or dry up on the ground. It is fairly safe to turn sheep amongst vines from the middle to the end of April, but it would be risky to overstock the vineyard, or the sheep might, after eating the leaves, begin crunching the wood."

THE INSECTIVOROUS BIRDS OF WESTERN AUSTRALIA.

By Robert Hall.

PART II.

BIRDS; INSECTIVOROUS AND VERMIN DESTROYING.

The present part constitutes a large section of birds that appear to have no face value to the orchardist. This is only as one imperfectly sees it. For the grower of all crops there is no doubt as to the positive services rendered by the birds as eaters of creeping things. Many of the feathered tribe live in the cereal and other crops, being ground living animals. There they do direct service. Others, as Grebes, and certain hawks, live away from the crops, but they check the ravage and increase of insects in the natural vegetation of the districts. The Rail and Dottrel, to each of which a reference is made, are representative of a large body of lagoon and creek-loving birds, of which the inland forms are very desirable members of our *avifauria*. That crows and ravens are fruit-eaters goes without saying, but whether they should be excluded from a review in such a part as the present one will need an exhaustive examination into their habits in general before a correct decision could be secured. As our State is at present, they are decidedly useful. The general Dacelo, Podargus, and Halcyon, together with the species of Heron, Ibis, and Plover, already mentioned, have been referred to in Part I., because of their special value.

Black-fronted Dottrel.

(*Ringed Sand-Piper.*)

Aegialitis melanops, Vieill. (*E'ji-a-li'tez mel'a-nops*).

Aigialos, the seashore; *melas*, black; *ops*, face.

Hiaticula nigifrons, Gould, "Birds of Australia," fol., vol. vi., pl. 20; "Key to the Birds of Australia," Hall, p. 83 (1899).

Geographical Distribution.—Areas 9 to 2.

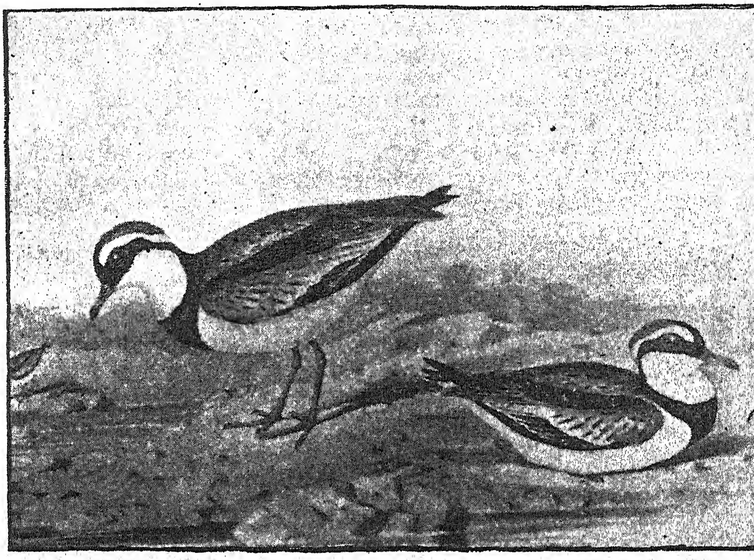
Key to the Species—

Adult.—Throat, white; black band across breast; abdomen, white; plumage of upper surface, plain; black of upper mantle united to black ear coverts, the white collar on hind-neck being thus separated from the white of sides of neck and under parts by a complete band of black; inner secondaries very long and pointed; the distance from shortest secondary to the tips of primaries more than half length of wing; culmen less than length of middle toe and claw.

Young.—Breast band absent; plumage and soft parts of a lighter colour and less definition than in the adult.

There are a number of small birds that frequent marshes and creeks. Sportsmen are quite familiar with them. Too small to

make "game" they get a liberty that falls to the lot of few water birds. When a flock bounds in its low flight with a zig-zag motion, the greatest temptation is given to the gunner. Only an amateur yields to it.



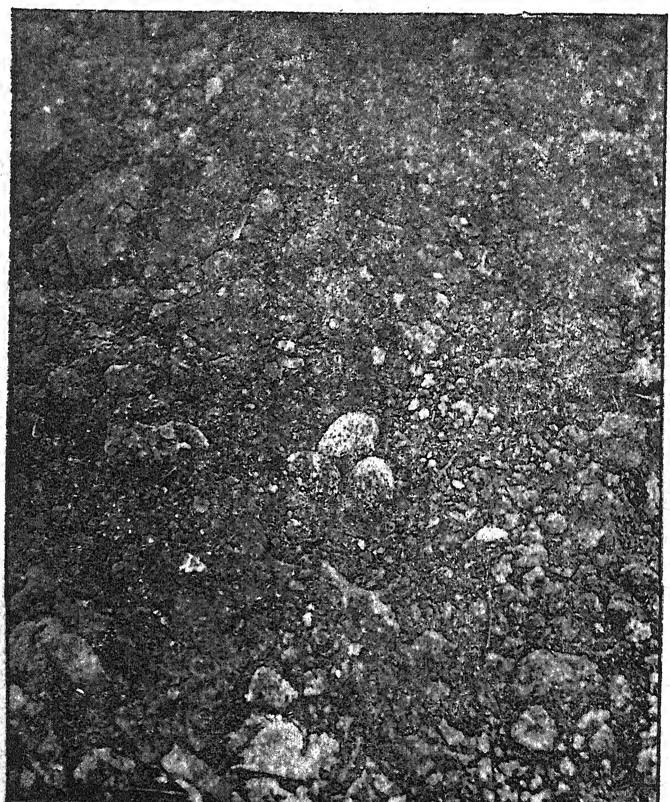
Black-fronted Dottrel.

In largely irrigated areas solitary pairs are to be seen along the artificial drains, keeping in check noxious animals that would flourish under well-watered circumstances. Channel and birds appear at the same time, grow together, and each in its own way helps the dependent vegetation to thrive and flourish. Handsome fortunes follow, other conditions being favourable.

The Dottrels that appear mostly to our notice are the present and the Red-capped species. The common name of the latter serves as a key to the species. No species is tamer than the Black-fronted, as it trips along the bank of a pool displaying an elegant little form and pretty eye. A pair most certainly did a daring act the time they chose a certain plot of ground on which to lay their eggs. Some six hundred sheep daily traversed two paths to a fresh-water lake. There were only twelve inches between the paths, yet the Dottrel scratched a shallow indent and laid an egg within it. Little birds have some very trying times, and to know how, in this case, they battled to keep the pattering sheep exactly in their lines would be interesting, to say the least of it. For the first few days, I should think, the sitting bird fluttered considerably, enough to make the hearts of the six hundred sheep beat with strong emotion. After three or four days they would understand each other.

Occasionally the birds will simply form a nest upon the drying mud by gathering a few pieces of clay that assimilates with the surrounding earth, and thus show a primitive nest.

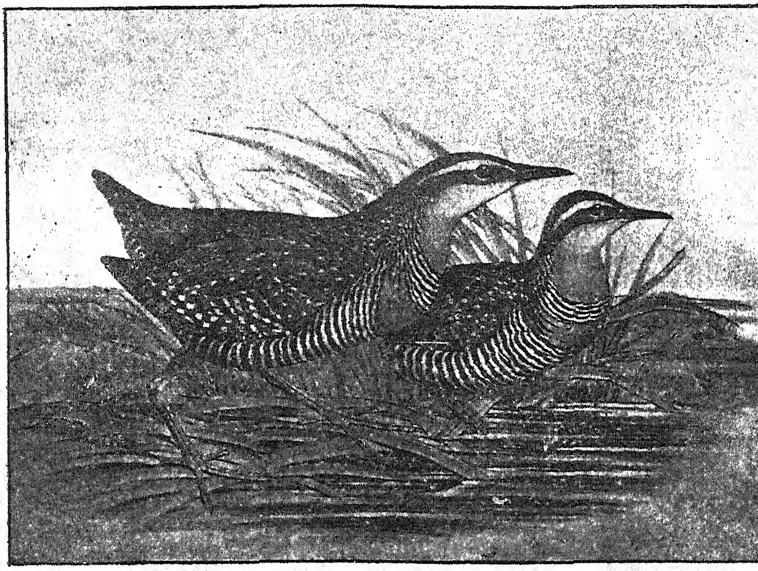
Six nests of this nature I remember being placed upon a border of a polygonum swamp. Because the water receded, they would not lay their eggs in them. This is the view I take of it after having observed, on many occasions, the sensitiveness of various species and of birds in which we would the least expect it. A favourite act of a single pair is to find the isolated drinking hole of cattle, and take up a nesting site in a dangerous thoroughfare of the kine. The accompanying illustration shows such a nest, taken with the camera of the author in conjunction with his friend, Mr. Arthur Lord.



Nest.—As a rule, the bare ground upon which the eggs are placed; at other times, a few pieces of brittle mud assimilating with the environment are placed together to form a rough circle;

no grass, no twigs. The eggs are always deposited on the bank of a swamp, water-hole, or creek.

Eggs.—Three to a sitting; pointed at one end; stone or cream colour, thickly spotted with brown. Length, 1·25 inches; breadth, 0·75 inch.



PECTORAL RAIL.

(*Land Rail.*)

Hypotaenidia phillippinensis, Linn. (*Hi-po-te-ne'di-a fil-ip-in-en'sis*).

Hupo, under; *taenia,* stripes; *eidos,* like; *phillipos,* Phillip; *ensis,* sword.

Rallus pectoralis, Gould, "Birds of Australia," fol., vol. vi., pl. 76; *H. Phillippinensis,* "Key to the Birds of Australia," Hall, p. 76 (1899).

GEOGRAPHICAL DISTRIBUTION.—Areas 3 to 9; very possibly 1 and 2.

KEY TO THE SPECIES.—Breast barred with white and more narrowly with black; white eyebrow; wing coverts olive, spotted on the margins with black and white; across the breast a broad band of deep sandy buff; toes long and slender.

A Rail seems to live the life of a recluse among grassy flats densely covered with herbage.

With a favourite setter or spaniel dog the birds are made to rise from the grass, first with a steep ascent a few feet into the air, and then rapidly away with a quick flapping near the ground and parallel to it. Without a dog the Rails refuse to leave their cover, and like travelling across petrel (*e.g.*, mutton birds) country, there may be hundreds of birds almost beneath the feet, in a long walk, without

a sound being made to advise one of the circumstance. The food of the species is made up of swamp animals, insects, grasses, and seeds.

Pectoral Rail—Nest and Eggs.

Between Victoria and New South Wales I remember finding a nest of this Rail, with a curious action attending it. While walking along the right bank of the Murray River at 1 p.m., my companions and I found a nest. It contained nine fresh eggs. Returning at 6 p.m., we found that only one egg remained in the nest, and that a cold one. In this isolated spot, we concluded, because the rushes had been slightly disarranged, the birds had carried away eight of the eggs and left the last on account of our too early return. We left this egg, and decided to inquire into the case in the morning. The remaining egg was then as we left it, and a diligent search of all the clumps of rushes gave us another nest with eight fresh eggs in a deep and roomy chamber. They were of similar markings, shade of ground colour, and proportions as the single one. This second nest was 200 yards, approximately, from the first, and just on the

far side of a narrow but deep inlet of the Murray. If this was the set removed by the pair of owners, how did they manage it? Probably by the bills, as they seldom fly, and are excellent runners. When they had come to the inlet, did they swim across? They rise from the ground to fly so heavily that the eggs would scarcely get safely over in either bill or claw. It is just possible that a pair of bush rats found the prize.

Nest.—Bowl-shaped, deep, loosely constructed of grass, and hidden in a resting position among rank grass.

Eggs.—Eight to ten for a sitting; cream colour, with reddish brown blotches irregularly distributed over the surface. Length, 1·5 inches; breadth, 1 inch.

Black-throated Grebe.

(*Dabchick, Diver.*)

Podicipes novæ-hollandiæ, Steph. (*Po-dis'i-pez. no-ve-hol'an-di-e.*)

Podex (podic), rump; *pes*, foot; *novæ-hollandiæ*, of New Holland.

Podiceps gularis, Gould, "Birds of Australia," fol., vol. vii., pl. 81; "Key to the Birds of Australia," Hall, p. 104 (1899).

Geographical Distribution—Areas 8 to 1.

Key to the Species—

Adult.—Summer plumage: Toes provided with wide lateral lobes, united at the base; tail vestigial; chin and throat black; fore neck smoky-brown; a chestnut band alongside of neck from the eye, plumage above sooty-black; grey on back; secondaries equal to or very little shorter than the primaries. Out of breeding season. Chin, throat, and under parts white.

Young.—Sides of head and neck striped with white.

Adult.—Winter plumage: The markings of head and neck are plain brown as on the upper surface.

The three species of Australian Grebes are found in our State, all being well distributed in the continent.

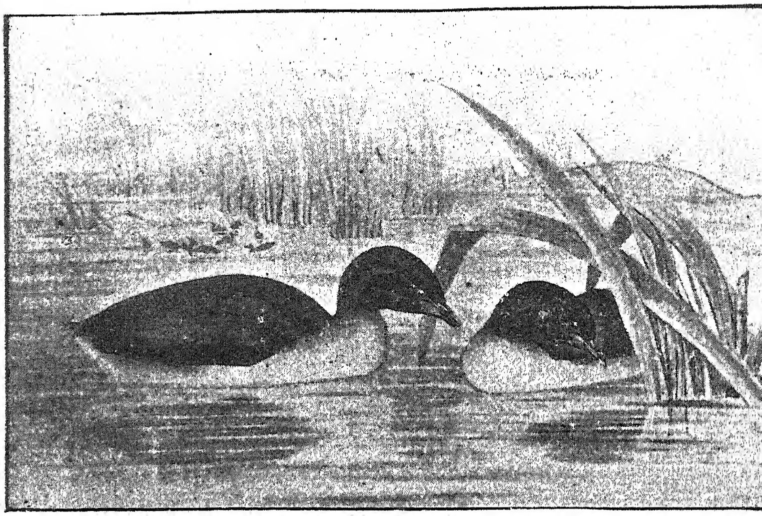
The differences between this family and all others in the Southern Hemisphere is particularly marked.

Grebes seldom fly; the sustaining power of the wing being remarkably limited. By a strong effort, they rise from the water and fly to a distance of a few hundred feet or yards at the most.

Birds wanting in strong or ordinary power of wing locomotion generally have it in leg power.

This is a good example, judging by the journeys it makes when the pond dries and another is fifty miles from it. A heavy fall of water in a dry district in the night brings this and other "running" water-fowl by the next night. It is a remarkable fact that freshly-formed pools in the centre of a dry plain, with a radius of a hundred miles, are on the following two or three days tenanted with scores of water-fowl. The birds are provided with small and

feebly feathered wings, and travel as pedestrians do, according to our present knowledge.



Black-throated Grebe.

Then the nesting of Grebes is very different to that of other birds. They build a floating nest of water-plants upon the surface of a weedy and quiet little swamp. This is anchored to a rush or two to save it from the rough usage of an occasional angry wind. A well supplied provision of nature is now exhibited in hiding the eggs from view. It would be the easiest act in the world for a hawk to see 12 to 15 nests upon a placid pool if they were full of exposed eggs. But the easiest things are not given to hawks to do any more than to any other form of life. So the nest has a flap of weeds like those of the body of it, and this door without hinges serves the admirable purpose of being placed over the eggs each time the bird leaves it. In this kind of nest there is an amount of fermentation that generates heat to help incubation. For this reason, one will seldom see a Grebe sitting upon its eggs in the daytime. At least that is the writer's idea of the matter. The diving power of the bird is great, as nearly every boy and sportsman, who have once met it, well know. To discharge a full cartridge "dead-on" is no guarantee of a reward. After the first shot the bird dives out of danger between the time of the shot leaving the gun and its arrival at the spot where the bird was previously. This the Grebe arranges by noticing the smoke of the gun and diving before the shot arrives. Sight waves thus travel much quicker than lead pellets.

The food consists of water and land insects, snails, and tiny fish.

Nest.—A mass of weeds, about 12 inches in diameter; floating upon a lagoon.

Eggs.—Four to a sitting; chalky or light bluish-white when fresh, and dull brown or sienna when days older; length, 1·5 inches; breadth, 1 inch.

Kestrel.

(Sparrow-hawk.)

Cerchneis cenchroides, Vig. and Hors. *(Serk-ne'is seng-kroi'des.)*

Kerchne, the kestrel; *kenchros*, small grain; *eidos*, form.

Tinnunculus cenchroides, Gould, "Birds of Australia," fol., vol. i., pl. 13; "Key to the Birds of Australia," Hall, p. 3 (1899).

Geographical Distribution—Areas 9 to 1, excepting, possibly 1 and 2.

Key to the Species.—General appearance rufous; head streaked with black; tail barred with black and tipped with white. Total length, 11·5 inches; culmen, 0·75 inch; wing, 9·25 inches; tarsus, 1·5 inches.

Our smaller hawks are not well-known to us as a whole. It is perhaps a little unfortunate that we cannot tell our feathered friends and enemies when on the wing.

The Kestrel is not the true Sparrow-hawk (*Accipiter cirrhocephalus*), and the point is worth emphasizing, because the former is insectivorous, while the latter is strictly a bird of prey. To science fifteen species of kestrels are known, of which one is disseminated throughout Australia, excepting, possibly, the most northerly parts of the continent. Why it should be found at Derby in the West and Rockingham Bay in the East, and no further North I can only surmise. Some falcons go into our latitudes. These two general are anatomically closely connected, and Professor Alfred Newton suggests the possibility that both are descendants from the Sparrow-hawk of New Zealand, a bird of much higher courage than any Kestrel. Both sexes take part in incubation, the male sitting in the hollow of another tree during the night, but relieving its mate in the task of incubation, during the day. The eggs in my collection were taken from the deserted nest of the White-winged Chough. The young, which are three or four in number, when ready to fly, are without the yellow cere. The flight of the bird is buoyant and easy, and when performing circles high up in the air on a summer's day the characteristic flight is seen. I have noticed the remark that insects fly high during midday, and the Kestrel follows in pursuit. It is nomadic, and is guided in its wanderings according to the movements of the various insects and other food upon which it subsists.

The specific name applies to a certain disposition of the markings.

Cenchris is a species beyond Australia. It is not improbable *Cenchroides* was so named because of its likeness (*eidos*: like, form) to the form of that species.

Nest.—The *debris* in a hollow spout or on a cliff.

Eggs.—Four to a clutch; colour reddish-brown, the blotches and spots being heavier than the ground colour, and varying in intensity. Length, 1·5 inches; breadth, 1·2 inches.

Striped Brown Hawk.

(Western Brown Hawk.)

Hieracidea berigora, Vig. and Hors. *(Hi-e-ra-sid'e-ä; ber-i-go'ra.)*

Hierax, a hawk; *idea*, resemblance; *berigora*, aboriginal name of this hawk.

Ieracidea occidentalis, Gould, "Birds of Australia," fol., vol. i., pl. 12; "Key to the Birds of Australia," Hall, p. 3 (1899).

Geographical Distribution—Areas 9, 8, 7, 6.

Key to the Species—

Adult.—Under surface of body creamy white with fine brownish shaft streaks; upper surface sandy brown, feathers of lower back and rump tipped with rufous; cere pale yellow; tarsus transversely plaited near base of toes; commissure of bill distinctly notched.

Young.—Under surface is brownish with the shaft streaks deeper brown.

For a considerable period it was thought by naturalists in the East that the present species was confined to our State. In a recent year it was found to inhabit South Australia. More lately it has been found fairly plentifully in the Western parts of New South Wales and Victoria. The specific title *occidentalis*, as applied by Mr. Gould, means Western, and led many to believe it was strictly such a bird.

The common Eastern species of the same genus is known as *H. orientalis* (orient, east), which is also to be found here, and completely so through the continent.

Although Brown Hawks occasionally worry small birds, domesticated and at large, the greater portion of their diet is composed of insects, snakes, lizards, and carrion. When the grasshopper season arrives, an examination then, as at other times, will show their stomachs to be well laden with destructive insects or their caterpillars. The female hawks, like owls, are much larger than the males, though in this case it is not so well marked. The birds are to be found in pairs, excepting when a horde of caterpillars are travelling across the land. On such an occasion, Mr. Gould says, several hundreds will flock to stay the ravage, even though their view of the matter be quite a different one to ours.

Nest.—Open, cup-shaped, and large, made of sticks and lined with fibres or light twigs. The position of the nest may be high on a swaying branch, or near the ground in a stunted tree.

Eggs.—Two or three for a sitting; the ground colour may be very pale chestnut, with blotches of strong reddish-brown upon it, or the blotches may be light and one end of the egg have a whitish ground. Length, 2 inches; breadth, 1·5 inches.

THE FOWL TICK.

A PRACTICAL ARTICLE FOR PRACTICAL MEN.

By James Hadlington.

(Manager Grantham Stud Poultry Farm, Plumpton, Rooty Hill.)

Judging from the number of poultry keepers in different parts of the Commonwealth seeking advice upon how to successfully combat the "poultry tick," this pest must be spread over a pretty wide area, especially in the dryer districts. No doubt the prevailing drought has much to do with its present activity, as dry conditions are most favourable to its development and spread, and when there is a change to wet weather less will be heard of it. However, from what is known of its life habits, when stripped of its scientific names and its origin, which are variously stated, it ought not to be such a formidable pest to fight as it is generally assumed to be. No doubt it is bad enough, but nevertheless amenable to common-sense methods of eradication and prevention, and we venture to think that it is little, if any, worse to fight than the hen louse. Certainly its depredations are more severe, resulting sometimes in the decimation of whole flocks; but this is where its presence has not been suspected until the mischief has been done, or, if its presence has been known, for the want of knowledge how to combat it.

Its Life and Habits.—Its life, habit, and methods of attack are in many respects like those of the common hen louse, familiar to every poultry keeper; and if proper precautions are taken to keep off the latter, there is very little likelihood of the appearance of the poultry tick in sufficient force to work any destruction among a flock.

Eternal Vigilance Necessary.—The poultry keeper needs to be ever vigilant for these pests, because he cannot afford to combine poultry and vermin breeding—the latter is safe to make the former unprofitable. And it should be remembered that it is easier to keep clean than to get clean. It must, however, be understood that in some seasons, no matter what one may do, there will be more or less trouble with broody hens in this respect; but there should be no great difficulty in keeping other portions of the farm clean, that is to say, where a separate place is allotted to sitters, as it should be, and not set all over the farm, or wherever they choose to make a nest, because in that method trouble is pretty certain. As already stated, the life habit of the fowl tick is in many respects similar to the better known pest already referred to, and especially in the fact of its laying its eggs upon surrounding objects, such as the perches, nest boxes, and anything in close proximity to where the fowls roost, instead of on the fowl. And in this is the vulnerable point of both pests—destroy the eggs and they must, as a consequence, die out. But it will be said they not only infest the

perches and nest boxes, but every crack and crevice in the fowl house. That, no doubt, is so where they have not been looked after, or for want of knowing how they have not been destroyed; but the same applies to the hen louse.

How to Get Rid of Both.—Where the trouble is confined to the perches and immediate surroundings, the simplest and most effective method is to paint the perches with blue oil (wood preserving). No insect can stand it, and no eggs can hatch touched by it. But it is an evil smelling thing, and altogether too objectionable to paint the whole house with. Therefore resort must be had to something else, and this is kerosene emulsion, put on with a syringe or spray pump, such as are used in the orchard for spraying of trees. With these a force can be obtained that will reach every crack and crevice. But one spraying is little or no use. It requires to be repeated two or three time at least, at intervals of a day or two, if these pest are in possession, but as a preventative once a fortnight in hot weather, and once a month or six weeks, in cold weather, will be sufficient to insure cleanliness in this respect.

How to Make the Emulsion.—Many find at first some difficulty in making kerosene emulsion properly. That is what is said to be stable "emulsion," meaning that the oil does not separate when it comes to stand. This is the trouble most people encounter although, why it is, if the recipe is strictly followed, I am always at a loss to understand. Many get some notion of putting in some other small ingredient, or perhaps use brackish water. These will cause failures. Only soft water should be used, and nothing added to the ingredients given.

To Make It.—Take 8oz. of soft soap and dissolve in upwards of a gallon of boiling water; take it off the fire and add one gallon of kerosene; stir this briskly for 10 or more minutes, until the oil is thoroughly incorporated with the soap and water, then add slowly at first 13 gallons of soft water. Sometimes when the water is very cold it will cause a separation of the oil. So this should be guarded against by making the water lukewarm before mixing. Carbolic acid may be added, in proportion of a tablespoonful to two gallons, with advantage as a disinfectant.

The Poultry Tick here referred to should not be confounded with the better known suck louse (or tick), as it is called, often prevalent upon chickens in the coastal districts, and from which its habits seem distinct. The suck louse is found upon chickens sometimes when only a few days old, always on the poll of the head and under the throat, where they seem to spend the whole of their existence from the eggs, which are much easier discovered than the insect itself. These are most destructive to chickens under six months old, and a sharp lookout should be kept for them. If a flock of chickens seem to be pining away with no apparent cause, the presence of this pest may be suspected. One of the simplest remedies for this pest is Quibbel's disinfectant fluid, diluted with two-thirds water, and applied to the poll of the head and under the

throat with a small gum brush, or anything of that description. This involves a good deal of trouble, seeing that every chicken must be handled; but it is the only way to combat them, as they never leave the poll except in migration from one to the other. But generally a couple of times application, if done inside a week, is sufficient to clear them, at any rate for some time. Any kind of fat is also good, but it must be used very sparingly, or injury to the chicken will result. The above remedy will also be found effective in loosening the poultry tick on the adult fowl.—*Home and Farm.*

INSECT PESTS.

THE SEARCH FOR PARASITES.

The Secretary for the Department of Agriculture has received the following report from Mr. G. Compere, Entomologist, who left here a short time back for the Eastern States to search for parasites to some of the most troublesome insect pests of this State. The parasites referred to as having been sent has been received and liberated in gardens affected with Mealy Bug:—

" Sydney, March 20.—Since my arrival here several trips have been made to country districts, with a view of locating the most suitable hunting-grounds for beneficial insects, and also a convenient locality to establish headquarters, where all useful insects collected may be cared for. Conditions have changed considerably, owing to the prolonged drought. No matter in what direction one may look, the dire effects of it may be noticed, and the heat in most sections of New South Wales is considered phenomenal for this time of the year. On farm and orchard alike nothing but a dreary and withered outlook strikes the observer. Even the citrus fruit trees in many places have a dry and parched appearance that does not augur well for the ensuing crop. At the Hawkesbury Agricultural College, where cultivation is carried on under the most advantageous conditions, the crops show unmistakable signs of the adverse season. The farming community are not the only ones, however, that feel the effects of the present unusual drought, as the supply of domestic water for this city is becoming very low, and the Government have issued notices to all consumers that the use of water for private gardens and lawns must be discontinued. This, if no rain falls soon, will in a short space of time give the resident portion of the city a very different appearance from what it usually has. Fruits.—The retail shops—which, by the way, are nearly all owned and kept by Italians—make a very good display of all varieties of seasonable fruits, and prices are fairly good from a grower's point of view, and for most varieties the retail prices are very little, if

any, less than for the same in Perth or Fremantle at the present time. Choice peaches are retailing at from 2s. to 2s. 6d. per dozen, and the same for pears; grapes, from 4d. to 6d. per lb.; but there is also plenty of cheap fruit upon the market, but of very inferior quality. There are apparently very little, if any, restrictions against the sale of fruit infested with insects. I shall leave for the country in a day or two, to try and secure some locust parasites, which, I expect, will be hard work, owing to the dry condition of the country at the present time, but shall write you fully upon my return as to what success met with."

(Continued April 1.)

"By this mail I am sending, addressed to the Department, a package containing larva, pupa, and beetles of the ladybird (*Cryptolæmus montrouzier, Muls*). The beetles should be at once liberated in places infested with mealy bugs, and the larva and pupa should be placed in one of the jars with wooden covers, and also liberated as fast as they reach the beetle stage. There will be no danger of secondary parasite with this species. The larva of this will at times be found feeding upon various species of young scale, but the mealy bug is its favourite bill of fare. I shall try and secure more for future sendings. As yet I have been unable, owing to the severe dry condition of the country, to secure any specimens of grasshoppers from which to breed parasites. I have been all over the Wagga, Albury, and Corowa districts, but not a trace of hoppers could be found, so that I must look in other directions for them. A little rain began to fall in those districts at the time of my leaving there, but not enough to do much good."

MARRAM GRASS FOR ARRESTING AND RECLAIMING DRIFTING SANDS.

REMARKABLE RESULTS.

Mr. A. Molineux, F.L.S., general secretary of the S. A. Agricultural Bureau, makes the following report of the success of the marram grass, not only in stopping drift, but also of making valuable grazing areas where before were only waste drifting sands:—

"At Port Fairy, Victoria, and along the coast in places the sand hummocks became denuded of shrubs, grasses, and other vegetation through the grazing and browsing by sheep and cattle, and the sand began to drift over the adjacent rich and valuable soil at a most alarming rate, even to the extent of overwhelming the houses and gardens. Land in the cities and suburbs of Warrnambool, Port Fairy, and elsewhere along the coast was far too valuable to be calmly relinquished, and strenuous exertions were made to stem the advancing tide of destruction, but with no success until the Port Fairy Municipal Council consulted the late Baron Ferd. von Müeller,

who suggested that marram grass might prove effective, and provided some seeds for experimental sowing in the year 1883. The results were astonishing, even to the Baron himself, and now, after eighteen years of planting (for it has been found cheaper, quicker, and easier to propagate from plants than from seeds), where there were miles upon miles of absolutely bare sand hummocks slowly overwhelming land and houses of inestimable value, there are now many miles in length of waving grass 2ft. to 4ft. high, capable of maintaining one cow per acre throughout the whole year, or five or six head for four months during the winter, when forage is somewhat deficient on the richer adjacent lands.

"Marram grass, for the purpose of arresting drifting sands, stands far ahead of all other plants. It cannot be destroyed by fire, as has been demonstrated sometimes when a fire has occurred on the Port Fairy plantations, but springs again stronger than before. Mowing and feeding off by stock only increases its vigour and vitality, making the grass grow more thickly and of a much finer texture and better quality; and digging out for replanting seems to improve the density and fineness of growth more than anything else. The small roots left in the sand send up fresh shoots, and the locality soon puts on the appearance of a field of rye upon which too much seed has been sown.

"Marram grass possesses another extraordinary property, in that opposition and persecution only make it more active and vigorous in growth. Where the sand drifts the most—after the plant has taken hold by its roots—there the grass grows the most vigorously. As the sand accumulates over the grass, fresh growths come up, even though the final elevation may reach 100ft. above the original level; but wherever the angle of elevation on the windward face of the hill exceeds 45°, the sand does not rise with the wind, and it would therefore be wise to secure such a condition by planting the face of the rise with grass. It was very remarkable, in the Port Fairy plantations, to note the very slow growth of the marram grass where the sand could not drift owing to the protection afforded against the prevailing winds by adjacent sandhills.

"Mr. S. Avery, the park ranger, who has full charge of the plantations, informed us that he always commences planting at the point most distant from the source whence the sand comes, thus making a barrier to its further progress, and at the same time securing the certainty of most rapid growth of the grass on the rest of the drift from the seaward. He always plants across the course of the prevailing winds, though not necessarily in long straight lines because the contour, elevation, and direction of the faces of the hills cause variations in the force and direction of those winds. He usually plants a strip of six rows, at 6ft. apart, with 2ft. between the plants, on the brow of the hill most distant from the source of the drift; another six rows at 60yds. to 80yds. nearer the incoming drift; and a third or fourth six rows at any distance according to circumstances and requirements. As the plants become established the intervening spaces become filled by fresh plantations, and as the plants mature they produce great quantities

of seed, some of which germinates, and finally the whole area is covered with a dense growth. Great care is taken to plant alternately in rows, so as to have a wall of grass opposed to the drifting sand.

"Mr. Avery never cuts off any of the top of the grass before planting, as he is convinced that the long grass on the surface arrests the sand, thus stimulating growth, and any rain that falls is caught in the leaves and conveyed to the roots below. Where the sand is very loose the grass should be planted 12in. to 15in. deep; but where it is rather firmer 9in. is deep enough. One man digs the holes and another plants the grass, spreading the roots and treading the sand in firmly. It is not advisable to loosen the adjacent sand any more than can be avoided. A "plant" consists of as much grass with roots as can be grasped in one hand, and it requires 3,630 plants for one acre. About 2,800 plants weigh one ton, so that 26cwt. of grass would be needed to plant one acre. In places where loads of marram grass had been laid on the ground and untied the bands have started to grow, and dense masses of grass now stand on the spots.

"The Port Fairy Municipal Council has now a deal more of the grass than is needed for extention of its plantations, and, as is usual with all municipal bodies, has always a number of men awaiting employment. For this reason the council is pleased to find work for the unemployed in digging the grass for sale at cost price; or thereabout, to any applicants from other States. They can dig, tie, carry, and place the grass on the railway trucks at Port Fairy for 30s. per ton.

"The cost of digging the grass is 12s. per ton, and an acre of grass three years old will supply 10 tons. To dig and replant the grass on adjacent sand hummocks costs £2 10s. per acre. When the grass is well established cattle may safely be put to graze upon it. Summer is the best time for grazing marram; but for three or four months in winter four or five cows can be grazed on an acre; the average, however, is one beast per acre all the year round. Cows maintain their condition and milk on marram grass, we were told, but there was some splendid clover and grass pasturage on the adjacent commonage when we were on our visit. This is probably deficient during winter.

"Amongst other uses for marram grass can be mentioned thatching, litter for stables, and rough plaiting material, as well as weaving, etc., for coarse baskets.

"As illustrative of the extreme vitality of marram grass it may be mentioned that when the first consignment was sent to Newcastle, N.S.W., some delay occurred in its transmission and delivery. The town clerk of that municipality telegraphed, "Grass arrived; totally useless; nothing but straw." The reply from Port Fairy town clerk was, "Plant out straw as directed." The engineer, M. Zerwonki, who had charge of reclamation on sand drifts, did as directed, and everybody was astonished at the wonderful growth of the supposed dry straw. Marram grass has been known to start growth after it has been out of the ground for three months; but it would be wise to plant it as soon as convenient after it is dug up.

SUCCESSFUL WHEAT GROWING IN SEMI-ARID DISTRICTS.

BY MARK ALFRED CARLETON, *Cerealist, Division of Vegetable Physiology and Pathology. From the U.S.A. Year Book.*

INTRODUCTION.

There has been much discussion in recent years of the question of the future wheat supply of the world, and in some quarters fears have been expressed that by the end of the next 30 years we may experience a universal wheat famine, provided that the present rate of increase of the bread-eating population and the present yield of wheat per acre shall continue.[1] It is not the purpose to enter into this discussion here, except to say that the subject is at any rate one which deserves serious consideration, and is of interest from the standpoint of the agricultural scientist, as well as from that of the statistician. Whether such a failure in the wheat supply shall come sooner or later, there is no question as to the need of giving attention to all possible means of increasing the product of the lands that are already farmed. By this means there may be accomplished the double purpose of increasing not only the general supply of wheat, but also the profits derived by the individual farmer from a given amount of land. At present a very good opportunity of making improvements which shall be productive of immediate returns is to be found in the development of the semi-arid districts.

There is no general agreement among agriculturists as to what part of the country may be properly called semi-arid and what part should be considered completely arid. Ideas concerning the line that should separate the semi-arid from the humid region are equally indefinite. In fact, there is possible need of a fourth term —semi-humid—to designate a region lying between these last two. In this paper the term semi-arid may be understood to refer, approximately, to that portion of the Great Plains lying between the ninety-ninth and one hundred and second meridians, to portions of eastern Washington and Oregon, and to those small portions of the Rocky Mountain and basin States where crops are grown without irrigation. The condition in these semi-arid districts are at times very discouraging. They are characterised by great extremes, occasional abundant harvests and partial or entire failures, following each other at intervals of two to five years. These occurrences are

---

1 Sir William Crookes's presidential address before the British Association for the advancement of Science, at Bristol, September 7, 1898; *The World's Wheat Supply*, by Sir Lawes and Gilbert, London, 1898 (reprint of letter in *London Times*, December 2, 1898); Edward Atkinson, *Popular Science Monthly*, Vol. LIV., pp. 145-162 and 759-772, December, 1898, and April, 1899; John Hyde, *North American Review*, Vol. CLXVIII., pp. 191-205, February, 1899; C. D. Roper, *Popular Science Monthly*, Vol. LXV., pp. 776 and 777, October, 1899; *The Wheat Problem*, by Sir William Crookes, London, 1899.

closely associated with corresponding periods of extremes in temperature and rainfall. Such extremes also occur often during the same season, so that the weather may in a single season be so favourable for one crop as to secure an excellent harvest, and yet be exceeding unfavourable for some other crop. For example, in the middle States of the Plains it is seldom that large harvests of both wheat and corn are obtained in the same year. As the wheat harvests in this region are, with a good rainfall, always excellent compared with those of other districts, any improvements that would insure conditions favourable to a good average harvest in all seasons are of the greatest importance. There will soon be no more new lands to be opened to settlement that are suitable for wheat culture, consequently an increase in the average yield of such lands as these is one of the means which must be depended upon in order to increase the general supply of wheat. Moreover, it is a matter worthy of note that the wheats usually grown in semi-arid districts possess a very high quality of grain. They are always hard-grained, and furnish a large amount of gluten of the best quality. The same climatic features that cause aridity—namely, extreme heat and drought—are fortunately those which also produce an excellent quality of grain when acting in conjunction with a soil rich in nitrogen.

IS A YEARLY CROP OF WHEAT POSSIBLE IN SEMI-ARID DISTRICTS WITHOUT IRRIGATION?

It is only in exceedingly small portions of the wheat-growing area, especially in Utah, Idaho, and Colorado, that wheat has yet been grown by irrigation. In all other portions where irrigation is at all desirable, it is the testimony of irrigation engineers, and is at least the general belief of cultivators, that only a very small percentage of the lands can be irrigated—perhaps no more than 10 per cent at most. But even where irrigation can be carried on the cost may be so great that the additional yield obtained thereby will not justify the practice, especially if a fair average crop be produced every year in semi-arid districts without it. It is the belief of the writer that this is possible, at least, over very large areas.

It may be noted by any careful observer that occasionally there are farmers in these districts who seem always to have a good crop of wheat whatever the season, even when there may be failures of the crop all about them. As other farmers in the vicinity have the same climate, and approximately the same kind of soil, such differences in results can not be due to differences in these conditions. They are simply due to certain methods of agriculture adopted by these farmers by which they are able to overcome unfavourable conditions of the weather. The Russian farmers who settled years ago in various portions of the Great Plains region have been especially successful in wheat-growing in those localities. Coming originally from regions of constantly recurring droughts and cold winters, they have long ago learned how best to combat such adverse conditions. Many of these farmers, including a large

number of the Mennonites, from the government of Taurida, who settled in McPherson, Harvey, Ellis, Graham, and other counties of Kansas, have always grown wheat quite extensively and with comparatively few failures. During the years 1895 and 1896, when the wheat crop was almost an entire failure in large portions of the Great Plains, these farmers continued to have good harvests. In the autumn of 1896 the writer visited a number of these farms in McPherson Country, when most of the thrashing had been done and much of the wheat was being hauled to the markets. The usual average yield was 22 to 25 bushels per acre, and occasionally there were yields of 30 and 35 bushels. The grain generally overweighed, reaching often 62 pounds per bushel.

In south and east Russia fair average yields of wheat of superior quality are obtained where the climate is characterised by great extremes of heat and cold and the rainfall is considerably less than on our Great Plains near the one hundredth meridian. The larger part of the most valuable Russian macaroni wheat, and much of the red-grained Russian and Ghirka spring wheats, in quality equalling our Dakota Fifes and Blue Stems, are produced east of the Volga, with an average rainfall of 15 inches or less; while the excellent hard winter wheats of the Crimea, Don territory, Kharkov, and north Caucasus endure the most rigorous winters and are grown with a rainfall and summer temperature similar to that near the one hundredth meridian, from Kansas to South Dakota.

The average yearly production of wheat in Kharkov government during the four years 1896-1899 was 11,438,850 bushels, with an average yield of 7·7 bushels per acre.[1] Almost one-fifth of this production is winter wheat, although the climate is apparently parallel with that of the Nebraska and South Dakota border. The normal rainfall at the city of Kharkov is 19·4 inches per annum, 2 inches less than at Huron, S. Dak.[2] Statistics, however, do not reveal the fact, known to the writer, that a large part of the fall-sown crop of the most excellent quality is grown east of the city of Kharkov, where the climate is much more severe, characterised especially by dry, cold, winter winds. In the government of Stavropol, in north Caucasus, the average yearly production is 12,249,210 bushels, of which nearly four-fifths is winter wheat. The average yield per acre is 6·8 bushels for the years 1896-1899, including one extremely bad season. Here the temperature is milder than in Kharkov, but the rainfall is very light and particularly uncertain. In the larger part of the government, where most of the wheat is grown, no meteorological records are kept, but the rainfall probably averages under 18 inches.

On the other hand, in Kansas the average yield per acre for the part of the State lying west of the ninety-ninth meridian for the

[1]Calculated as accurately as possible from the reports of the central committee of statistics of the Ministry of the interior of Russia for the years 1896-1899.

[2]All figures concerning rainfall are averages taken from "Die Regenverhältnisse des Russischen Reiches" (Wild), S. 12-28, Kaiserl. Akad. der Wissensch., St. Petersburg, 1881 and 1887; also "Report of the Chief of the Weather Bureau" (Harrington), 1891-92, U.S. Dept. Agr., Washington, 1893.

years of 1895-1899 was 6·7 bushels,[1] 1 bushel less than in Kharkov, where the climate, in both winter and summer, is much more severe.

A still better example for comparison is to be found in the wheat production of the lower Volga region of east Russia. In this region are comprised the three governments of Samara, Orenburg, and Astrakhan. The climate is characterised by the greatest extremes of heat, cold, and drought. An average of the normal yearly rainfall of six points, scattered pretty well over the entire territory, is 12·7 inches—a precipitation approaching that of regions practically arid. Yet, this is one of the principal wheat regions of Russia. The average yearly production for 1896-1899 was 44,980,050 bushels, and the average yield per acre 6·6 bushels.

For Turkestan, which in a broad sense may be considered to include Ferghana, Syr-Darya, Samarcand, and Transcaspia, no satisfactory statistics have yet been reported, but rough estimates made in the year 1892 for the report on agricultural industries of Russia, prepared for the World's Columbian Exposition, made the annual production of wheat at that time about 15,000,000 bushels, and that of all other grains about 16,000,000 bushels. The average yearly rainfall is 6 to 10 inches, or even less, and the summers are characterised by intense heat. Nevertheless, a large part of the wheat crop is grown without irrigation, though all winter wheat is irrigated. The yields per acre are not reported, but are said to be very fair, even on unwatered (bogarny) lands.

That the yield of wheat does not depend upon the absolute amount of rainfall is established by facts well known in our own country. In the Palouse region of Washington and Idaho 12 inches yearly rainfall is usually considered to be sufficient for a good crop of wheat, while in the plains States 21 inches is not supposed to be sufficient, the conditions of culture being approximately the same in the two regions. In the former region the nature of the soil makes it much better able to conserve the moisture that does fall. In that part of Oregon near The Dalles the average yield of wheat without irrigation during the last three years, according to the vice-director of the Oregon Agricultural Experiment Station, was 23 bushels per acre on summer-fallowed land. In 1900 it was 25 to 44 bushels per acre. Yet the climatic conditions there are such as prevail in regions practically arid instead of semi-arid. The rainfall at Moro, in that district, during the year November 1, 1897, to November 1, 1898, was 8·64 inches, estimating the amount for September (for which there is no record) as a mean between August and October, which, according to experience, is approximately correct.

The facts furnished by the foregoing comparisons, and many others which lack of space precludes mentioning here, are, it seems to the writer, sufficient proof that a constant yearly crop of

[1] Calculated from reports of the secretary of the Kansas State Board of Agriculture for the years 1895-1899.

Drought-resistant Wheats—Hard Winter Varieties.
1 Turkey (Crimean); 2. Odessa White Chaff; 3. Odessa Red Chaff;
4. Roumanian White Chaff; 5. Kharkov; 6. Ulta.

good average yield may be depended upon over far the larger area of the semi-arid districts. The importance of such a proposition, if true, must be generally acknowledged. The question then naturally arises, how is this constant yearly crop to be secured. If we exclude such examples as those of eastern Oregon and the Palouse region, where the natural condition of the soil is unusually favourable for great conservation of moisture, it will be found that any marked increase in average yields in the semi-arid districts may be secured in two ways: (1) By a proper selection of hardy varieties, and (2) by proper methods of culture.

VARIETIES BEST FOR SEMI-ARID DISTRICTS.

As already stated, the conditions of soil and climate of the semi-arid districts are usually such as are adapted for the growth of the glutinous, hard-grained wheats. This is a matter so important that only such varieties are to be considered, as a rule, although in districts like the Palouse region the composition of the soil is such as to permit a deterioration in the gluten content of the grain. There are three general classes of wheats from which we may select varieties that are in various degrees more resistant to the adverse conditions of these districts than those now grown and therefore able to produce larger average yields. These are (1) the red spring wheats; (2) the hardy winter wheats; the macaroni wheats.

RED SPRING VARIETIES.

It would hardly be supposed that any varieties of red spring wheats could be obtained better fitted for cultivation in the Dakotas than the well-known Fifes and Blue Stems now grown in those States. There are seasons, however, when even these excellent varieties are seriously damaged by drought in a large portion of this region; while there are several varieties of the very best milling quality in extreme east Russia and western Siberia, which in such seasons would probably be better able to withstand the drought, as they are grown in the lower Volga region, already mentioned as a region of the severest extremes of climate. These varieties are both bearded and beardless, the best sorts, however, being bearded. Probably the best one of all is the variety called simply Russian,* a bearded sort, very hard, red-grained, and extremely resistant to drought. It produces fair crops under conditions as arid as those of the Ural and Turghai territories, just across the Ural River, in Siberia. The next best sort of this class is the variety Spring Ghirka, so commonly grown as to have become the chief export variety of the Volga region. It is without beards and possesses a grain with a thin bran and a very large percentage of gluten of excellent quality. It is rather similar to the Fife wheats of this country. Judging from many series of analyses made of various wheats, it is probable that these varieties possess the highest gluten content known among bread wheats.

* No. 2955 of the Section of Seed and Plant Introduction of this Department.

HARDY WINTER VARIETIES.

The establishment of winter varieties is the most difficult problem in the entire work of securing wheats adapted to semi-arid conditions. The difficulties in the way are double those encountered in connection with spring wheats, since the winter sorts have to withstand both drought and cold. The effect of the cold is also all the more severe because of the accompanying drought. Nevertheless, if once such varieties are successfully established and the winter-wheat area in these districts thereby widely extended, the importance of the accomplishment will probably be admitted by all wheat growers. In addition to the well-known general truth that the same variety sown in the autumn, if able to withstand the winter, will usually give a larger yield of better grain than if sown in the spring, it is also true that winter varieties are able in particular instances to overcome the effects of spring drought better than spring-sown grain, because of their great reserve force in the amount of root growth attained the previous autumn. Besides, winter sorts are often more likely to escape certain diseases on account of their earlier maturity.

To show the value of the use of these hardy varieties of the Russian type one needs only to call to mind the Crimean wheat, known under the misleading name of Turkey, which has been grown for twenty-five years or more in Kansas, and is now also grown extensively in Nebraska, Iowa, and Oklahoma, and to a lesser extent in other parts of the country. By its hardiness it has entirely revolutionised the winter-wheat industry of the middle Plains States. Fresh importations of seed from the Crimea or other parts of the government of Taurida have been made at different times, until now the variety is universally recognised as an indispensable component of the agriculture of these States. By means of this single variety alone the winter-wheat flour of these States has risen in reputation to be a well recognised rival in foreign markets of the output from Minneapolis and Budapest. Its cultivation has at the same time caused a very marked extension of the winter-wheat area, which was not before possible because of the severity of the winters.

Even this variety, however, occasionally succumbs to the winters in parts of Iowa and Nebraska, and fails entirely in South Dakota, Minnesota, and Wisconsin, where winter wheat ought to be and probably can be grown. It is therefore very desirable to secure varieties still hardier than the Turkey. That it is possible to do so appears now almost certain from investigations made by the writer during the past two years in east and south Russia.

The region of Russia from which, at present, the hardiest winter wheats originate includes the following governments: Southern Kherson, Taurida (including the Crimea), Ekaterinoslav, Kharkov, Don territory, Voronezh, the southern portions of Tambov and Saratov, the northern portion of Kuban territory, and the northern and eastern portions of Stavropol. The region corresponds very

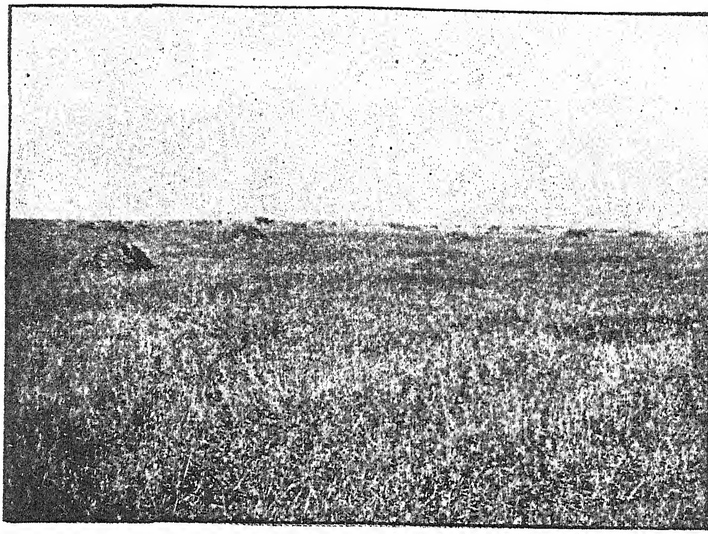


Fig. 1.—Field of Macaroni Wheat, near the Azov Sea, Russia.

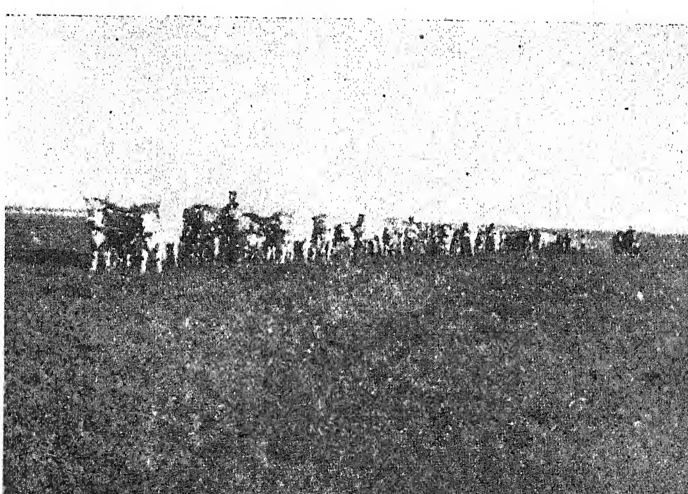


Fig. 2.—Ploughing the "Black Fallow" on a large Estate in Northern Taurida, Russia.

fairly with that portion of our Great Plains, including Kansas, Eastern Colorado, Nebraska, Iowa, South Dakota, and portions of Minnesota and North Dakota. It lies in the middle of the black soil (chernozem) belt, and therefore includes the very richest lands, and has a climate marked by great extremes of temperature and severe droughts.

One of the best of the winter varieties to be obtained from this region is the Kharkov Winter wheat from the eastern part of Kharkov government, near Starobelsk. This district possesses a climate nearly or quite as severe as that of South Dakota. Summer droughts are common, and in winter the effect of the cold is much increased by the dry, piercing winds and absence of snow. This wheat is therefore probably one of the hardiest of all known winter varieties, and ought to be able to withstand the winters of South Dakota and Minnesota. It is bearded, and has a white chaff and very hard red grain. At this point it may be noted that all the most hardy winter wheats are bearded, and usually have a white chaff, though the grain is red. The Turkey or Crimean is of this kind. It is probable that all these Russian hardy winter varieties are of one common general type, but possess different degrees of hardiness depending upon the climate of the locality in which they are grown. (Pl. LXVII.)

The variety Beloglino, grown in the extreme northern portion of Stavropol, north Caucasus, is rather similar in hardiness to the Kharkov wheat, but is probably a little more drought resistant and perhaps a little less resistant to cold. It will therefore be adapted to districts considerably west of the one hundredth meridian of our Great Plains, perhaps as far as extreme western Nebraska and eastern Colorado. In 1900 this variety apparently possessed the hardest, most glutinous grain of all the Russian winter wheats. The varieties Ulta and Buivola, from central and eastern Stavropol, near the Kuma River, are also very resistant to drought and of excellent quality. There is much alkali in this district, and the rainfall diminishes rapidly towards the Caspian Sea. At a distance of 150 miles east of the city of Stavropol it is probably less than 15 inches per annum. Here there are also severe dry winds, and in the driest periods the air is filled with dust.

Several other Russian varieties and certain Roumanian sorts are also quite drought resistant, and possess a good, hard red grain, but are not so resistant to cold as those just mentioned, though some of them compare very well with the Turkey in this regard. Two of the best of these are the Odessa White Chaff and the Odessa Red Chaff, grown in the district near Odessa. The grain is very hard, apparently of excellent quality, and the yield good. The best variety of Roumania, which approaches very closely in quality of grain and resistance to drought to those of extreme south-west Russia, is the Roumanian White Chaff. All of these three varieties ought to give excellent results in Oklahoma, northern Texas, and a large part of Kansas.

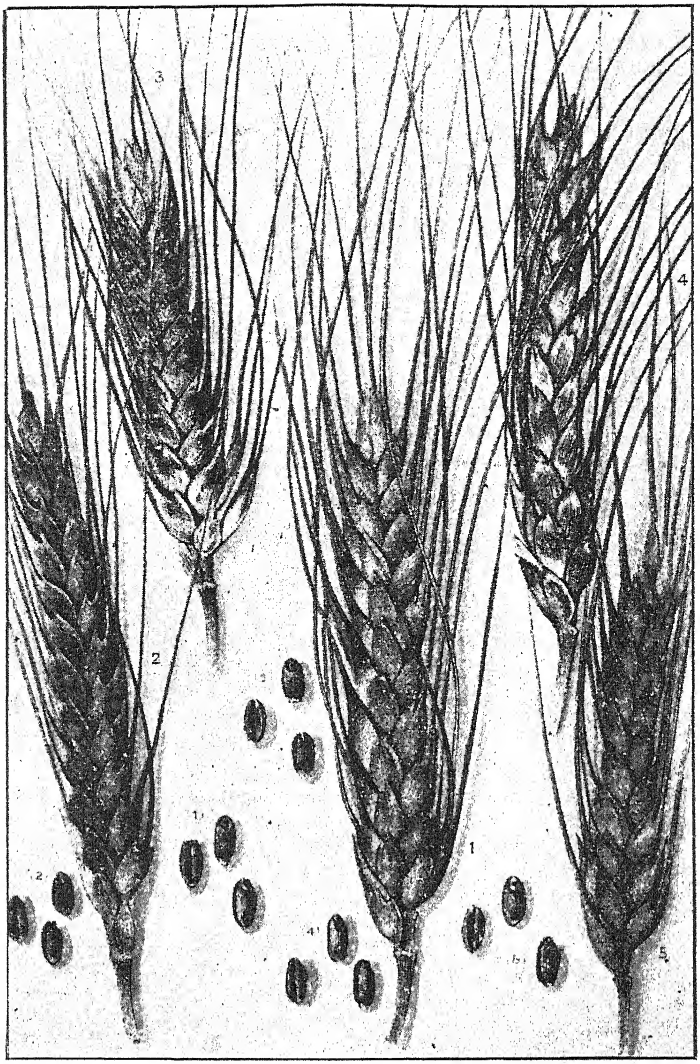
MACARONI VARIETIES.

The greatest endurance of drought is exhibited by wheats of the durum group, commonly called macaroni wheats. In eastern Russia, Turkestan, and Algeria these wheats flourish under climatic conditions so extreme as to be perhaps properly called arid, rather than semi-arid. In these regions very fair crops are produced with 10 to 12 inches or less of rainfall per year. Experiments made by this Department with these varieties have already given sufficiently favourable results to show without question that they are admirably adapted to the driest portions of our Great Plains, and will probably prove successful also in Arizona, New Mexico, Utah, and the drier portions of Oregon and Washington.

In a number of instances these varieties, when grown in the same locality with the ordinary bread wheats in the States of the Great plains, have given. in seasons of unusual drought, a yield two to four times as great as that of the ordinary wheats. In addition to drought resistance, these varieties have also the advantage of being resistant to the attacks of leaf rust and other parasitic fungi. On the other hand, they are very liable to injury in severe winters, and must be used as spring varieties north of the thirty-fifth parallel. South of that latitude they may be sown in October or November, and become practically winter wheats. By gradual adaptation through selection they may be made later to endure the winter farther north. As winter varieties they furnish abundant fall pasturage.

Apparently the only obstacle in the way of complete success with macaroni wheats is the present uncertainty of the market—an obstacle, however, which will no doubt very soon disappear. As these wheats are employed almost solely for making macaroni and similar pastes, a market will have to be found either for export to to southern France and Italy, or by stimulating sufficient demand among our own macaroni factories to establish a home market. At present our own factories make their macaroni from the common bread wheats, using, especially, flour from the Minneapolis and Kansas mills. Already some of these factories would be glad to use the true macaroni wheats if they could readily obtain the flour. As the factories do not grind their own flour, the one thing remaining is to create a sufficient interest among the flour mills to induce them to provide the proper machinery for grinding these wheats. They are so much harder than even the hardest of our bread wheats that certain changes in milling machinery are apparently needed in order to be able to grind them.

When macaroni wheat is mixed with 20 or 25 per cent. of red wheat in grinding, it also makes what is considered in eastern Russia an excellent quality of flour for bread. In fact Kubanka, the chief macaroni variety, is the most popular for making bread in that region. All the mills along the Volga grind this wheat in large quantities.



Drought-resistant Wheats—Macaroni Varieties.
1. Kubanka; 2. Nicaragua; 3. Velvet Don; 4. Black Don; 5. Wild Goose.

The three principal varieties of macaroni wheats imported on a large scale by the factories of France and Italy are Gharnovka, or Arnautka, from the Azov Sea region, and Kubanka and Beloturka from Eastern Russia. (Pl. LXVIII., fig. 1.) These are all white chaff sorts, with yellowish white grains, appearing vitreous in fracture, and are of the highest grade among macaroni varieties. A black-bearded variety with velvet chaff and dark-coloured grains, and a black chaff variety are also grown in the Azov and lower Volga regions. (Pl. LXIX.) All these varieties have been introduced by the Department of Agriculture and distributed through the State experiment stations. The variety Sarui-bugda is an excellent white-chaff sort, grown mostly in Turkestan. A number of valuable varieties of macaroni wheats are also grown in Algeria, of which Medeah, Pellissier, and El Safra are among the best known. These Algerian sorts are probably best adapted in this country to districts south of the thirty-fifth parallel. Polish wheat is also sometimes used for making macaroni and other pastes. It is grown principally in south and east Russia, Turkestan, and the Mediterranean region.

In the Palouse region and similar districts, the natural conditions being rather exceptional, there is also a special demand for wheats of the club, or square-head, group, or sorts of a similar nature, which are of good yielders, ripen early, do not shatter, and though drought resistant are at the same time soft wheats. Such varieties are found in Turkestan, and several of them have been introduced by the Department.

METHODS OF CULTURE.

The selection of hardy varieties is an especially favourable means of *extending* the wheat area or the area for a certain class of wheats. To aid in making a good yearly crop within this area *constant* and *certain* it is necessary, in addition, to practice proper methods of culture. Even with an excellent variety in use, there are localities where the majority of the farmers have concluded that it is impossible to produce a paying crop each year, and that occasionally an entire failure is inevitable on account of drought or the severity of the winter. But, as already mentioned, there are often other farmers in the same localities who continue to have good harvests year after year, with the same natural conditions of climate and soil. By proper treatment of the soil these farmers have simply conserved moisture that the others have lost, and which was necessary to mature the crop. It is not simply the amount of moisture that falls, but the amount that is retained in the soil that is of chief importance. Half the average rainfall of places near the one hundredth meridian would be plenty for a crop of wheat if it could all be utilised and at the right time. In the Palouse region the soil is naturally in condition to hold much moisture. In the region of the Great Plains the farmer must aid nature by proper tillage to accomplish the same end.

TIME AND MANNER OF PLOUGHING.

The importance of very early ploughing for wheat can not be too strongly urged. In recent years early ploughing has apparently become more common than formerly, but it is not yet so universally practised as it should be. If wheat it to follow wheat on the same land, the present crop should be removed at the earliest date possible, if for no other reason than to permit immediate ploughing. For spring wheat, ploughing should by all means be done the previous autumn or summer, however dry the ground may be. By alternate freezing and thawing during the winter the ground will be brought into good condition for further tillage the following spring. Let the first ploughing be comparatively deep; afterwards all further cultivation should be near the surface, and should include discing or harrowing, or both, every four or five weeks (preferably after a rain) until seeding time. This process not only prevents evaporation, but keeps the land constantly and thoroughly clean of weeds.

Careful investigations will show that summer fallowing is in most instances unprofitable. In some portions of the country the practice is attended with much actual loss, which is apparently not fully realised. The object of summer fallowing is to conserve moisture and to give the soil an opportunity to accumulate a supply of certain available constituents by means of a year's rest, during which time the land is cultivated, but no crop is sown upon it. There is no doubt that much moisture is conserved in this way, but that purpose may be largely accomplished by early ploughing, and in case of spring wheat by ploughing the previous autumn. Of the solid plant foods, potash, phosphates, and nitrogen are among the most important for wheat, and are usually present in great abundance in prairie regions. In the semi-arid and arid districts the greater the degree of drought the less the amount of nitrogenous food there is present in proportion to mineral salts, and hence anything that will increase the supply of nitrogenous matter becomes of chief importance. It is well known that this increase is readily accomplished by the growth of the leguminous crops. In the States West of the one hundredth meridian, where there is great lack of nitrogen, leguminous cropping is especially needful. In the drier portions of the Pacific coast States summer fallowing is commonly practiced every second year. It is evident that is such cases this practice cannot be regarded as immediately profitable unless the value of a crop thus obtained be equal to that of the combined crops of two years without summer fallow, deducting from the latter the expense of one year's seed, harvesting, and thrashing. It is doubtful, however, if anyone ever expects such an increase of yield by this practice. Moreover, in many instances, as observed by the writer, the fallow is allowed to become covered with weeds, which exhaust the soil as much as a cultivated crop and give no returns. On the other hand, a leguminous crop will accomplish the threefold end of (1) giving an immediate profitable return from the soil; (2) of increasing the yield of the following crop of wheat; and, (3) in extreme cases, of helping to produce a more or less permanent

amelioration of the soil by neutralising the bad effects of the presence of an excessive amount of alkali.*

Lessons from Russian Methods.

Mention has been made of the success that has attended the practices of the Russian settlers in various localities of the Great Plains. These people have simply followed the methods they learned in their native country. In the southern and eastern wheat districts of Russia the people have contended with extremes of climate even more severe than ours for long periods of time. It should not be surprising, therefore, if they have learned to get the best results possible under adverse conditions. Even the peasants, crude as are their methods and ignorant as they would doubtless seem to us, have long been familiar with certain principles of agriculture not yet fully recognised in our own country.

There are many systems of crop rotation followed in the semi-arid districts of Russia, some of them having been practised for a long time. One system consists in planting melons as the first crop (baksha) on new ground, followed by Kubanka or Gharnovka wheat (macaroni varieties), then a hard red wheat, then a softer wheat or pasture crop. The land is then allowed to rest one or two years and a similar series of crops is afterwards repeated. There are also the three, five, and seven field systems, in which by the use of several fields it is possible to grow several different crops each year without growing the same crop twice in succession on the same field, while a period of rest can be given regularly to each field also if desired. In any system it is always the aim to grow melons or macaroni wheat on new land. Summer fallowing is practised considerably, but by no means in all cases. On the other hand, wheat is sometimes grown several years in succession on the same land, as is too often done in this country. But whatever the system of cropping and whether summer fallowing is practised or not, early deep ploughing at first and thorough tillage thereafter until seeding time are never neglected.

The Black Fallow.

Tillage among the peasants is usually with crude instruments. The plough (sokha) is a light machine of very primitive appearance, often drawn by one horse. After the first ploughing, which is always as deep as the nature of their implements will allow, instead of using a harrow, the land is lightly cross ploughed every month, or after every good rain, until seeding time. The wheat is sown by hand just before the last ploughing. In some cases the seed is covered by a sort of harrow instead of the plough. On the lands of the more intelligent farmers and on all the large estates a much more modern machine is used in ploughing. Large ploughs, rather similar to ours, are used in the first ploughing, which is usually very deep, apparently considerably deeper than ploughing is

*See Bulletin No. 24, Division of Vegetable Physiology and Pathology, U.S. Department of Agriculture, "The basis for the improvement of American wheats," pp. 10-25.

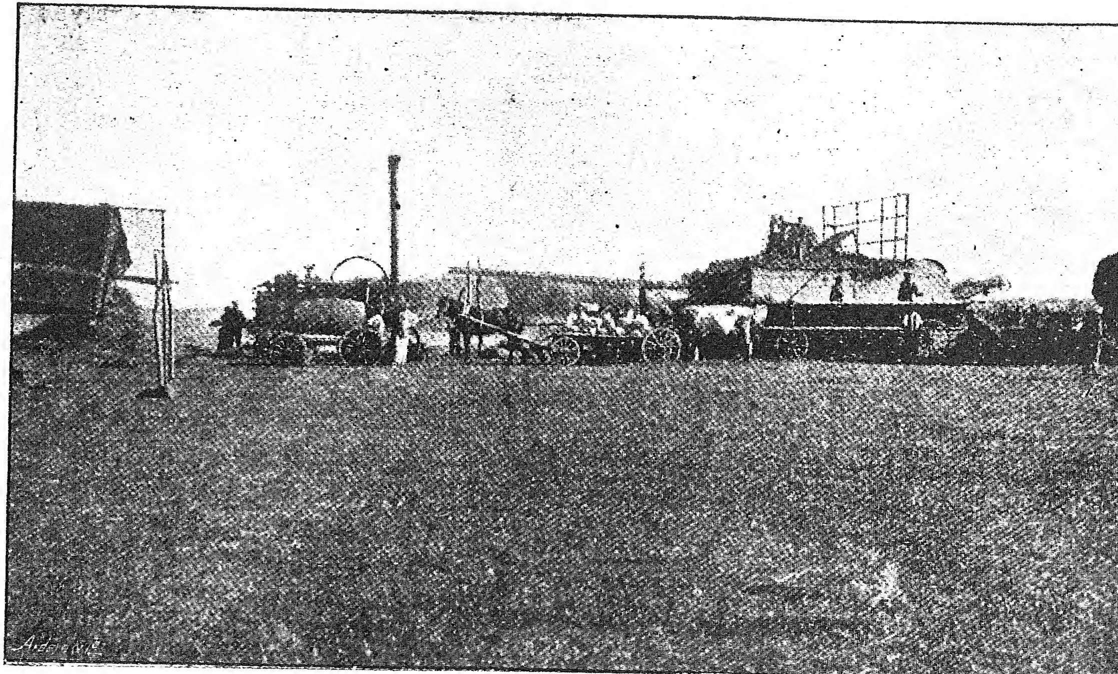
done in this country. The ploughs are usually ganged, two to one frame, and are drawn by three to five yoke of oxen. The driver never rides, and there is no provision for doing so. The subsequent tillage is performed by various machines, but usually by much lighter ploughs, five or six hung to a single frame, carried on three wheels, and drawn by two yoke of oxen. It is a common and interesting sight to see eight to twelve of these teams in a train ploughing on the large estates. (Pl. LXVIII., fig. 2.) The writer has counted fifty ploughs of a dozen different patters on one estate. In Pl. LXX. is shown a modern method of thrashing, which is also commonly practised on these large estates. At seeding time the harrow is used and the wheat is then drilled in. In these districts the fallowed land everywhere is so very dark in colour that it is commonly called the "black fallow" (chernui par). The term seems not to be restricted, however, to fallow land, but is apparently often applied also to early ploughing in preparation for fall or spring sowing. In the spring-wheat districts it is the universal practice, with no exceptions known to the writer, to plough early in autumn, and very deep, in preparation for the following spring crop.

METHODS OF SEEDING.

The first thing of prime importance at seeding time is a fine seed bed. If the previous cultivation has been properly performed, however, this will be a condition easily attained. It should be kept in mind that after the first plouging the entire subsequent tillage of the seed bed is a life-and-death struggle, with possible drought, for the retention of moisture about the roots of the future wheat plant. If this fact were properly appreciated and heeded and the wheat sown early, there would seldom be a failure of the crop in semi-arid districts in spite of the severest drought. Thorough cultivation should extend just a little way below the surface, while farther down the soil should be allowed to become packed, so that there may be the very least possible evaporation of moisture.

It is a pretty safe rule to follow the practice of sowing always at a date which is considered to be early in that locality. At the proper time the seeding should be done at once, without regard to weather conditions. Too many cases of partial or entire failures of crops have been the result of delay in seeding on account of waiting for rain or for some other cause. If a rain is expected the crop should by all means be in before it comes. The crop that is sown in good time comes up at once after the first rain, if not before, and is put far ahead of those sown just after a rain, much farther than would be caused by the difference in time alone. If a winter crop, it will have time to make a much stronger growth in preparation for the winter than the crops sown later, while in the case of spring wheats the early-sown crop, by ripening early, will be better able to escape certain diseases.

Of course, wheat seeding should always be done with the drill. The direction and depth of the drill rows are matters of the greatest



Threshing Wheat on the Estate of Mr. Ginter, at Yoshan-lei, in Northern Taurida, Russia.

importance in semi-arid districts, particularly in seeding winter wheats. The drill rows of winter wheat should by all means run east and west, for the manifest reason that the rows will then be able to catch the snows if any fall, and the winds instead of driving the fine dirt out of the rows will rather drive it into the rows and around the plants.

We never fully realise what measure of success of the winter-wheat crop is dependent upon proper methods of drilling. The drill rows need especially to be made deep; but the form of the rows is also a matter of importance. The evolution of methods of seeding is about in the following order: (1) Sowing by hand; (2) the use of the seeder, simply a machine taking the place of the hand, with no force feed and not sowing the wheat in rows; (3) the ordinary drill with a force feed putting the grain in evenly in rows and deeper; (4) the press drill, which is probably the most perfect machine we have at present. We probably do not yet have exactly the ideal drill for winter-wheat sowing in districts of extreme drought. The proper kind of machine when made will possess a combination of features found in both the press drill and what is known as the lister drill. Each hoe of such a drill should operate somewhat similarly to a corn lister, but on a smaller scale, having a broad shovel-like construction above and a short-pointed portion below and a little behind, which would be the hoe proper. The shovels should go in about as deep as in ordinary corn cultivation and the hoe proper still 1½ or 2 inches deeper, with a packer of some kind following behind. When so planted, the wheat is put so far down that the growing roots are surrounded with the abundant moisture of the packed portion of the soil, and the fine surface dirt falls in around the plant from above, filling up the row to such an extent that it will require a severe winter indeed to kill out the plant to the roots. In case of spring wheats on land ploughed the previous autumn, by using the same method the moisture gathered during the winter will be so conserved about the roots that little more rainfall will be needed to mature a crop.

MAINTAINING AND IMPROVING THE QUALITY OF THE WHEAT.

The practice of the best methods of culture, with varieties most resistant to drought and cold, should still be supplemented by constant selection of the best grain each year for seeding the next crop. Having once secured a variety as nearly as possible ideal for the locality, it is then necessary to maintain the standard of the variety. But it is possible to do more than that; the variety may be so improved that it will become much harder and more prolific than the crop produced by the original seed. The Turkey wheat, even with the crudest sort of seed selection, has shown much improvement in hardiness in recent years, and is now grown much farther north than formerly. In some instances it seems also to have improved in drought resistance. If we select the hardest varieties at present at our command and practise the most rigid selection of seed from the hardiest plants each year, a still hardier crop will soon result, which

can be successfully established in a new locality with a climate still more severe, and the same process of selection can then be repeated. It is the belief of the writer that in this way the winter-wheat area may be extended northward almost indefinitely. There is an especially good opportunity for making improvements in this way in seasons of unusually severe winters, like the year 1898–99 in Nebraska, or in seasons of unusually severe drought, if one is particular in such cases to select seed from the surviving portions of the crop in fields most exposed to the weather. Spring wheats may of course be improved in a similar way with respect to drought resistance, yield, and early maturity.

GARDEN NOTES FOR MAY.

(By Percy G. Wicken.)

Owing to the unavoidable delays in publishing the *Journal* early in the month, and in consequence the Garden Notes often appearing too late to be of any use to settlers, I propose in future to publish these notes a month in advance, consequently there will be no notes for April, and those for May appear in this issue.

Most districts in which any garden operations are carried out will by this time have been favoured by a good fall of Autumn rains, and in consequence garden operations should now be in full swing. All heaps of manure that have been made during the summer months should be dug into the ground as early as possible, and those who have been to the trouble of making a compost heap of all stable refuse and rubbish will now find the benefit to be derived from it. All ashes should also be kept in an old barrel, and may be dug into the ground when required. They contain a good percentage of potash, and are useful on this account. A good four or five-pronged fork, and even a four-pronged hoe, will be found useful for breaking up the ground and turning the manure under, and the soil may be left in a rough condition for some time, so as to allow it to sweeten before sowing seed or putting out young plants. Most of the work in gardens has to be carried out by means of hand labour, and for this purpose some of the various "Planet Junior" hand tools will be of great advantage as a means of saving labour. Where land is worked on a larger scale there are plenty of implements which can be worked by horses for this purpose, but that is outside the scope of these notes. It must be

borne in mind that there is likely to be plenty of wet to come in the next few months, and that provision should be made in laying out the garden to carry as much of the surplus water away as possible. All plants require plenty of water, but it must be kept moving; stagnant water means death. This is well illustrated by the ordinary flower-pot. As long as the water can pass through the hole in the bottom, all is well. Plug up this hole, the water becomes stagnant, and the death of the plant is the result. This action takes place in the ground; allow the water to become stagnant, and the plant turns yellow and dies.

Asparagus.—It is not necessary to plant this out until the spring, but the ground takes some time to prepare, and should be got in readiness as opportunity offers. A trench should be dug about two feet deep, the top soil being placed on one side, and the lower soil on the other. This enables the soil to be placed back in the same way as taken out, and not leave the sour soil on the surface. Mix in with the soil in the trench a good supply of well-rotted stable manure, and you are ready for planting when necessary.

Beans, Broad.—These may be sown largely this month, but are much neglected in the State. They should be sown in drills from one to four feet apart, according as to whether they are dwarf or tall varieties.

Beans, French.—A few can be sown where there is no danger of frost, in the very warm districts.

Brussel Sprouts.—These are a very nice vegetable, and should be grown by everyone for home use. They make a very welcome addition to the table. Seed may now be sown in a seed bed, and when the plants are large enough plant out about two feet apart in well prepared soil.

Cabbage.—Sow a small quantity of seed as required, so as to keep up a supply of young plants, and plant out any young plants that you may have; only healthy young plants should be transplanted; those too old or spindly will not prove profitable.

Cauliflower.—Plant out from seed bed, and sow more seed for future planting.

Carrot.—Sow a plentiful supply for home use, a surplus supply will be appreciated by the farm horses. The Early Shorthorn is a good variety to grow.

Celery.—Plant out in a well-manured trench any young plants that you may have available.

Leeks.—Sow largely of this wholesome plant, and plant out any young plants that you may have ready.

Lettuce.—Sow sufficient seed to meet your future wants, and plant out any plants you may have on hand.

ONION.—Plentiful supplies of this useful vegetable can now be sown, they are always useful. The surface soil requires to be brought to a very fine tilth. The seed may either be sown direct in drills, and thinned out later on, or they may be planted in beds, and the young plants pricked out when ready; the latter way is more tedious, but prevents the young plants from being smothered in weeds when very small, the transplanted plants have a start on the weeds, and, therefore, make a quicker growth.

PARSNIP.—Seed of this vegetable may be sown; the ground requires to be dug deeply, and no fresh manure should be applied to the crop.

PEAS.—If you have not enough already sown, sow as many as possible; a plentiful supply of green peas is always welcome. Climbing varieties should be staked as early as possible, and the soil kept well worked between the rows. Do not apply nitrogenous manures to this crop: superphosphate and sulphate of potash, and a liberal supply of lime are required.

TURNIPS.—A few may be sown to keep up a succession.

FARM.—Operations will be chiefly confined to the sowing of all cereal crops. It is now getting late in the season, and it should be remembered that the earlier sown crops almost invariably give the best returns. All wheat should be sown, if possible, before the end of the month, and the oats as soon after the wheat as possible. Farmers will find their yields improved by effecting a change of seed every two or three years. It is a mistake to keep on growing seed from the same crop on the same ground year after year. All farmers should try a few experiments on their own account by growing a few promising varieties of wheat to see which do best, and also by trying the results of several different manures on small areas of land. These experiments, although small and expensive themselves, may often lead to large results.

ORCHARD.—The pruning season will now be at hand, and all pruning implements should be got into order, and arrangements made for properly pruning the trees and vines during the winter. A sharp lookout should be kept for insect pests, and the trees all treated to a good strong winter application of one of the various insecticides. This will help to keep the trees clean during the next summer.

MARKET REPORT.

FOR MONTH ENDING 8TH APRIL, 1902.

The West Australian Farmers' Co-operative Company, Limited, City Markets, Perth, report having successfully inaugurated the new business, which is being conducted purely upon co-operative lines. The profits, after paying interest on capital subscribed, will be divided amongst shareholders according to volume of business transacted through the Company. The Company is receiving every encouragement from all parts of the State, both with applications for shares and consignments of produce for sale. Prices realised during past month have been as follow:—

Farm Produce.—Chaff market past month has been fully supplied, and market has remained very steady. Prime green lines, £3 15s. to £3 17s. 6d. per ton; dry chaff, prime quality, £3 10s. to £3 12s. 6d. per ton; prime oaten chaff, £4 per ton; inferior chaff, for cow feed, £2 10s. to £2 15s. per ton. Bran market firm, £7 5s. to £7 7s. 6d. per ton. Pollard, £7 7s. 6d. to £7 10s. per ton. Oats, Algerian, 3s. 7d. to 3s. 10d. per bushel; New Zealand and Tasmanian oats, 4s. 1d. to 4s. 2d. per bushel. Wheat.—Market firmer, 4s. 2d. to 4s. 3d. per bushel, truck lots; smaller lots, 4s. 5d. to 4s. 6d. per bushel. Maize, 4s. 9d. per bushel. Peas, 6s. per bushel. Potatoes, prime local lots, £9 per ton. Imported potatoes plentiful, Tasmanian and Mount Gambia arriving in good order, worth £7 15s. to £8 5s. per ton. Seed potatoes dull of sale, £7 10s. to £9 per ton. Onions, £8 per ton; pickling onions, £9 per ton.

Dairy Produce.—Good demand for prime local butter, 1s. 5d. to 1s. 7d. per lb., very few consignments offering; imported butter, 1s. 2d. to 1s. 5½d. per lb. New Zealand cheese, 9½d. to 10d. per lb. Bacon, best imported, 10½d. to 11d. per lb. Local eggs scarce, 2s. 6d. to 2s. 10d. per doz. Honey, 12s. 6d. to 15s. per 60lb. tin.

Fruit.—Grapes have been plentiful, but supplies are now considerably less. Prime muscatels, 8s. to 10s. per case; doradillas, 5s. to 7s. per case; wine grapes, 3s. to 4s. per case. Apples, good supplies, prime table varieties, 9s. to 18s. per case; cooking apples, 6s. to 7s. per case. Pomegranates, 4s. to 5s. per case. Passion fruit, 7s. to 8s. 6d. per case. Plums, imported, 4s. to 4s. 6d. per case. Lemons, 22s. 6d. to 25s. per case. Oranges, 21s. to 24s. per case.

Vegetables.—Cabbage, 5s. 6d. to 10s. per cwt.; beans, 1½d. to 2½d. per lb.; turnips, 1s. 3d. to 1s. 6d. per doz. bunches; parsnips and carrots, 1s. 9d. to 2s. per doz. bunches; pumpkins, 4s. 6d. to 5s. per cwt.; tomatoes, 5s. to 5s. 6d. per case; marrows, 2s. 3d. to 2s. 6d. per doz.

Poultry.—Market has been very dull, but prospects are now better. Table fowls, 5s. to 6s. 6d. per pair; inferior fowls, 4s. 6d. to 4s. 9d. per pair; chickens, 3s. to 4s. 6d. per pair; ducks, 5s. to 7s. per pair; ducklings, 4s. to 4s. 6d. per pair; turkeys, 14s. to 24s. per pair; turkey hens, 10s. to 11s. per pair; geese, 9s. to 10s. 6d. per pair.

Pigs.—We cleared several heavy lines during past month. Well bred sows, 60s. to 70s. each; forward stores, 22s. to 28s. each; prime porkers, 30s. to 35s. each; backward stores, 12s. to 18s. each; suckers, 6s. 6d. to 10s. each; carcase pork in active demand, 6¾d. to 7d. per lb.

THE CLIMATE OF WESTERN AUSTRALIA DURING MARCH, 1902.

The climate maps for the State show that the month was characterised by high barometers and temperatures and very scanty rainfall. After experiencing a comparatively cool summer up to the end of February, a spell of hot weather set in on the 8th, lasting until the 19th, and during that time the daily maximum temperature throughout the State, and especially in the South-West, was several degrees above the average. In Perth, the mean maximum temperature, from the 8th to the 19th, was 95·7, and on three occasions exceeded 100deg.

The following table giving the mean maximum, mean minimum, and mean temperatures for March at a few selected places, compared with the average for previous years, may be interesting:—

	March, 1902.			Previous Years.		
	Mean Max.	Mean Min.	Mean.	Mean Max.	Mean Min.	Mean.
Geraldton	89·6	63·9	75·2	83·6	63·0	73·3
Cue	98·7	70·5	84·6	93·5	66·3	79·9
Coolgardie	89·6	61·5	75·6	85·5	58·3	71·9
York	92·2	57·6	74·9	84·0	59·0	71·5
Perth	88·6	63·0	75·8	84·5	60·7	72·6
Bunbury	81·4	56·7	69·0	77·8	57·3	67·6
Katanning	85·6	53·5	69·6	79·7	51·8	65·8
Albany	73·9	56·4	65·2	70·4	57·7	64·0
Esperance	79·2	58·9	69·0	76·3	57·8	67·0

It will be seen from the above figures that the weather was exceptionally warm for March, but records show that on several occasions similar weather has been experienced, notably in 1888, when the mean maximum temperature at Perth was 1deg. higher, and on 18 days the maximum temperature exceeded 90deg., as against 14 this year.

The only portion of the State where rain to any extent is expected is in the tropics, and there, practically, none fell, except on the coast in the Kimberley district, where the total amount was about 50 per cent. below the average. None fell in the North-West or over the goldfields, and only very light showers throughout the South-West and South.

W. E. COOKE,
Government Astronomer.
(*per* H.M.S.)

9th April, 1902.

The Climate of Western Australia during March, 1902.

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					March, 1902.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
NORTH-WEST AND NORTH COAST:															
Wyndham ...	29·846	29·804	29·945	29·749	97·3	77·5	87·4	102·2	70·5	98·2	79·4	120·0	70·0	244	2126
Derby	29·862	29·828	29·951	29·736	99·6	76·0	87·8	102·8	64·0	95·8	76·2	109·0	61·0	56	1477
Broome ...	29·874	29·793	29·946	29·748	93·8	75·9	84·8	102·5	63·0	92·5	76·1	103·0	64·0	352	2017
Condon ...	29·867	29·801	30·017	29·770	96·7	73·2	85·0	102·2	56·5	93·4	75·2	103·8	65·0	*Nil*	1980
Cossack ...	29·876	29·802	30·024	29·756	99·8	76·5	88·2	107·9	67·0	96·6	77·4	113·0	65·0	*Nil*	1250
Onslow ...	29·862	29·864	29·987	...	100·9	75·5	88·2	112·2	65·0	96·9	71·6	116·0	54·0	*Nil*	1250
Carnarvon ...	29·920	29·886	30·034	29·785	90·9	71·4	81·2	109·2	63·0	91·3	69·6	112·0	54·0	25	322
Hamelin Pool...	29·928	29·882	30·076	29·820	98·7	68·7	83·7	109·0	58·8	95·5	66·8	112·8	50·6	*Nil*	416
Geraldton ...	29·993	29·979	30·138	29·899	86·6	63·9	75·2	107·0	52·0	83·7	63·1	109·0	48·0	3	40
INLAND:															
Hall's Creek ...	29·889	...	30·065	29·819	97·0	69·0	83·0	102·0	54·8	92·1	82·1	100·0	56·4	56	1369
Marble Bar ...	...	...	...	...	99·7	74·3	87·0	110·0	59·6	...	...	...	...	5	1108
Nullagine † ...	29·862	...	30·083	29·701	102·8	69·0	85·9	107·5	55·0	90·8	70·2	101·0	59·5	*Nil*	1194
Peak Hill † ...	29·906	29·878	30·050	29·702	96·8	71·8	84·3	103·3	60·2	90·9	68·6	102·4	52·8	3	1459
Wiluna ...	...	...	...	...	95·7	64·9	80·3	103·8	49·0	...	...	...	...	*Nil*	969
Cue	29·945	29·868	30·152	29·766	98·7	70·5	84·6	107·8	59·0	96·3	66·9	108·2	49·5	*Nil*	627
Yalgoo ...	29·946	29·890	30·114	29·753	96·9	68·0	82·4	106·0	57·0	93·1	64·8	107·7	48·6	*Nil*	340
Lawlers ...	29·968	29·932	30·231	29·805	94·0	68·0	81·0	104·3	53·0	88·6	64·8	105·1	46·8	Nil	594
Laverton ...	30·010	...	30·214	29·809	92·8	64·9	78·8	103·1	48·0	...	...	...	...	*Nil*	496
Menzies ...	30·028	29·936	30·237	29·817	90·9	64·9	77·9	102·0	50·0	89·1	62·0	105·0	46·0	*Nil*	621
Kalgoorlie ...	30·084	29·973	30·274	29·873	89·2	62·2	75·7	101·4	48·6	86·4	60·3	104·0	47·5	*Nil*	350
Coolgardie ...	30·038	29·992	30·251	29·812	89·6	61·5	75·6	102·9	47·5	87·3	59·0	104·2	46·0	*Nil*	253
Southern Cross	30·002	29·951	30·221	29·749	92·0	58·2	75·1	104·5	49·0	88·3	57·7	106·0	40·0	33	243
Walebing ...	...	...	...	...	92·7	60·4	76·6	105·0	46·0	...	...	...	...	15	18
Northam ...	...	...	...	...	92·9	59·4	76·2	107·0	49·0	...	...	...	...	39	39
York	30·064	30·016	30·243	29·801	92·2	57·6	74·9	104·3	43·3	84·1	59·7	107·0	41·0	*Nil*	*Nil*
Guildford ...	...	...	...	...	91·3	59·7	75·5	106·0	47·0	...	...	...	...	4	20

* The figures for previous years have been given whenever there are at least four years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded. † Averages for three years only.

The Climate of Western Australia during March, 1902—*continued.*

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					March, 1902.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan 1.
SOUTH-WEST AND SOUTH COAST:															
Perth Gardens	30·040	30·024	30·233	29·876	88·6	63·0	75·8	103·0	53·5	84·7	60·9	106·2	46·0	7	21
Perth Observatory	30·050	29·987	30·235	29·888	86·1	62·4	74·2	103·3	52·9	81·5	61·2	101·8	45·9	8	19
Fremantle ...	30·042	30·008	30·211	29·905	81·4	64·4	72·9	99·8	57·0	80·1	62·3	105·0	48·0	5	9
Rottnest ...	30·046	29·977	30·215	29·890	78·8	65·4	72·1	93·4	57·8	78·9	61·7	101·0	51·0	3	7
Mandurah ...	...	...	...	...	85·7	59·2	72·4	99·0	46·0	...	...	...	...	5	33
Wandering ...	...	...	...	...	89·9	51·7	70·8	102·2	37·4	...	...	...	...	*Nil*	16
Collie	...	...	...	...	86·6	50·9	68·8	101·0	37·4	...	...	...	...	10	39
Donnybrook ...	...	...	...	...	85·7	53·4	69·6	99·9	41·1	...	...	...	...	16	91
Bunbury ...	30·072	30·038	30·247	29·897	81·4	56·7	69·0	96·5	40·2	77·9	57·7	97·0	41·0	4	36
Busselton ...	...	...	...	...	81·5	52·3	66·9	94·0	42·0	...	...	...	...	8	18
Bridgetown ...	...	...	...	...	84·8	48·2	66·5	101·0	36·0	...	...	...	...	19	49
Karridale ...	30·089	30·019	30·255	29·847	76·8	56·5	66·6	94·5	43·8	75·8	55·3	101·5	43·8	55	143
Cape Leeuwin	30·071	29·992	30·268	29·763	73·9	62·8	68·4	83·5	55·0	72·0	61·6	91·0	54·0	28	97
Katanning ...	30·072	29·991	30·282	29·811	85·6	53·5	69·6	103·0	38·0	80·3	53·0	105·0	39·0	9	22
Albany ...	30·118	30·085	30·310	29·780	73·9	56·4	65·2	85·2	43·3	70·3	58·1	98·0	41·0	46	123
Breaksea ...	30·110	30·042	30·312	29·755	70·0	60·0	65·0	80·2	50·8	69·1	59·2	90·5	48·0	44	133
Esperance ...	30·114	30·086	30·354	29·752	79·2	58·9	69·0	100·8	42·8	76·3	58·1	104·4	41·0	16	304
Balladonia ...	30·083	...	30·323	29·792	83·6	54·0	68·8	96·2	37·5	...	...	...	...	4	390
Eyre	30·126	...	30·357	29·820	77·2	54·3	65·8	95·2	40·2	...	...	...	...	30	308

* The figures for previous years have been given whenever there are at least four years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Observatory, Perth,
5th March, 1902.

W. E. COOKE,
Government Astronomer.

RAINFALL for February, 1902 (completed as far as possible), and for March, 1902 (principally from Telegraphic Reports).

Stations.	February.		March.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
East Kimberley:				
Wyndham ...	815	12	244	...
6-Mile	1013	13	...	...
The Stud Station	...	...	...	...
Carlton	...	...	...	...
Denham	621	6	...	...
Rosewood Downs	603	8	...	...
Argyle Downs ...	995	15	...	...
Lisadell	...	...	...	...
Turkey Creek ...	1034	16	131	6
Plympton, St. Mary	...	...	...	...
Koojubrin ...	...	...	...	...
Hall's Creek ...	614	13	56	2
Flora Valley ...	...	...	...	...
Ruby Creek ...	...	...	...	...
Ruby Plains ...	...	...	...	...
Denison Downs...	888	15	...	...
West Kimberley:				
Obagama ...	1133	14	...	...
Derby	594	7	56	2
Yeeda	641	11	...	...
Liveringa ...	686	10	...	...
Mt. Anderson ...	843	11	...	...
Leopold Downs...	761	12	...	...
Fitzroy Crossing	306	4	72	1
Fitzroy (C. Blythe)	561	11	80	2
Quanbun ...	...	...	...	...
Nookanbah ...	434	13	...	...
Broome	1150	...	352	...
Roebuck Downs	1163	15	...	...
Thangoo	912	13	...	...
La Grange Bay...	1404	18	138	5
North-West:				
Wallal	730	10	14	1
Condon	817	6	Nil	...
De Grey River ...	694	4	...	...
Port Hedland ...	408	3	Nil	...
Boodarie ...	402	2	...	...
Yule River ...	825	4	...	...
Warralong ...	381	5	...	...
Muccan	...	...	...	...
Ettrick	520	5	...	...
Mulgie	483	4	...	...
Eel Creek ...	400	5	...	...
Pilbarra	665	3	Nil	...
Coongon	...	...	...	...
North-West—*cont.*				
Warrawagine ...	...	...	...	...
Braeside... ...	...	...	...	...
Bamboo Creek ...	272	5	15	1
Marble Bar ...	674	4	5	1
Warrawoona ...	570	5	7	1
Corunna Downs...	455	3	...	...
Nullagine ...	308	4	Nil	...
Yandicoogina ...	...	...	...	...
Tambourah ...	...	...	...	...
Kerdiadary ...	564	3	...	...
Roy Hill... ...	151	3	...	...
Mosquito Creek	91	4	...	...
Mulga Downs ...	340	5	...	...
Woodstock ...	...	...	...	...
Mt. Florence ...	421	3	...	...
Tambrey ...	510	6	...	...
Millstream ...	...	...	...	...
Yandyarra ...	315	2	...	...
Mallina	406	2	...	...
Whim Creek ...	704	5	18	1
Cooyapooya ...	830	4	...	...
Woodbrooke ...	665	4	...	...
Croydon	...	...	...	...
Balla Balla ...	616	3	24	2
Roebourne ...	511	3	Nil	...
Cossack	545	5	Nil	...
Fortescue ...	113	4	11	1
Mardie	36	1	...	...
Mt. Stewart ...	...	...	...	...
Yarraloola ...	52	3	...	...
Chinginarra ...	...	...	...	...
Onslow	25	2	25	1
Peedamullah ...	68	5	...	...
Red Hill	...	...	...	...
Mt. Mortimer ...	334	3	...	...
Wogoola ...	...	...	...	...
Nanutarra ...	...	...	...	...
Yanrey	23	1	...	...
Point Cloates ...	2	1	...	...
Gascoyne:				
Winning Pool ...	44	2	34	3
Towara	80	3	...	...
Ullawarra ...	124	2	...	...
Maroonah ...	230	1	...	...
Thomas Police Station	...	...	...	...

RAINFALL—*continued.*

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
GASCOYNE—*contd.*				
Bangemall ...	378	4	...	...
Mt. Augustus ...	52	2	...	...
Minnie Creek ...	81	1	...	...
Yanyeareddy ...	68	1	...	...
Williambury ...	25	1	...	...
Wandagee ...	9	1	...	...
Bernier Island ...	...	...	...	...
Boolathana ...	Nil	...	...	...
Carnarvon ...	5	1	Nil	...
Cooralya	...	...	...	...
Doorawarrah ...	Nil	...	...	...
Mungarra ...	27	1	...	...
Clifton Downs ...	30	1	...	...
Gifford Creek ...	216	4	...	...
Dairy Creek ...	23	2	...	...
Mt. Clere ...	...	...	...	...
Errivilla	120	3	...	...
Dirk Hartog Island	1	1	...	...
Sharks Bay ...	5	1	Nil	...
Kararang ...	...	...	...	...
Meedo	...	...	...	...
Tamala	5	1	...	...
Wooramel ...	Nil	...	Nil	...
Hamelin Pool ...	Nil	...	Nil	...
Byro	79	2	...	...
Yarra Yarra ...	...	...	...	...
Berringarra ...	75	2	..	...
Mt. Gould ...	93	1	...	...
Moorarie	245	2	...	...
Peak Hill ...	373	5	3	2
Horseshoe ...	439	6	1	1
Abbotts	230	2	Nil	...
Belele	...	...	...	...
Mileura	87	3	...	...
Milly Milly ...	74	1	...	...
Manfred	78	2	...	...
Meelya	27	2	...	...
Woogorong ...	147	2	...	...
Boolardy	...	...	...	...
Billabalong ...	141	1	...	...
Wooleane ...	137	2	...	...
Murgoo	164	3	...	...
Meeka	36	2	...	...
Mt. Wittenoom ...	43	2	...	...
Nannine	146	2	Nil	...
Star of the East...	121	2	Nil	...
Annean	189	2	...	...

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
GASCOYNE—*contd.*				
Tuckanarra ...	110	3	Nil	...
Coodardy ...	113	3	...	...
Cue	107	2	Nil	...
Day Dawn ...	78	2	Nil	...
Lake Austin ...	49	2	Nil	...
Lennonville ...	141	2	1	1
Mt. Magnet ...	98	2	Nil	...
Warracoothara ...	270	2	...	...
Challa	180	1	...	...
Youeragabbie ...	60	1	...	...
Murrum	...	...	Nil	...
Yalgoo	115	2	Nil	...
Gabyon	220	1	38	1
Gullewa	162	2	Nil	...
SOUTH-WEST DIVISION (NORTHERN PART):				
Murchison House	13	1	...	...
Mt. View ...	62	1	...	...
Yuin	148	2	...	...
Northampton ...	18	1	7	1
Mt. Erin ...	64	1	...	...
Oakabella ...	...	...	...	...
Narra Tarra ...	...	...	...	...
Tibradden ...	40	1	Nil	...
Sand Springs ...	15	1	...	...
Mullewa... ...	21	1	Nil	...
Kookatea ...	54	2	10	1
Bootenal ...	15	1	...	...
Geraldton ...	5	1	3	3
Greenough ...	Nil	...	Nil	...
Dongara ...	14	1	Nil	...
Dongara (Pearse)	15	1	Nil	...
Strawberry ...	21	1	...	...
Mingenew ...	18	2	7	1
Rothesay ...	265	2	...	...
Field's Find ...	155	2	...	...
Carnamah ...	105	2	97	2
Watheroo ...	1	1	78	2
Dandaragan ...	Nil	...	1	1
Moora	Nil	...	2	2
Yatheroo ...	Nil	...	7	3
Walebing ...	Nil	...	15	2
New Norcia ...	Nil	...	10	1

RAINFALL—*continued.*

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
South-Western Division, Central (Coastal):				
Gingin	Nil	...	Nil	...
Belvoir	Nil	...	7	1
Mundaring ...	6	1	Nil	...
Guildford ...	15	2	4	1
Kalbyamba ...	9	2	6	1
Canning W't'r'w'ks	Nil	...	Nil	...
Perth Gardens ...	10	2	7	1
Perth Observatory	8	2	8	1
Subiaco	2	1	13	1
Claremont ...	9	2	6	1
Claremont (Richardson)	...	...	...	...
Fremantle ...	3	2	1	1
Rottnest	2	2	3	1
Armadale ...	4	2	...	...
Rockingham ...	4	1	8	1
Canning River ...	13	2	9	1
Jarrahdale ...	8	1	6	1
Mandurah ...	24	2	5	1
Pinjarra	20	2	Nil	...
Harvey	33	2	7	1
South-West, Central Part (Inland):				
Hatherley ...	2	1	65	3
Momberkine ...	...	...	...	...
Culham	3	1	...	...
Newcastle ...	Nil	...	Nil	...
Eumalga ...	Nil	...	4	1
Northam ...	Nil	...	39	1
Grass Valley ...	Nil	...	...	...
Meckering ...	Nil	...	...	...
Cunderdin ...	Nil	...	...	...
Doongin	3	2	...	...
Whitehaven ...	...	...	...	...
Sunset Hills ...	9	1	...	...
Cobham	1	1	...	...
York	Nil	...	Nil	..
Beverley ...	3	1	Nil	...
Barrington ...	Nil	...	...	...
Sunning Hill ...	...	...	...	...
Wandering ...	16	2	Nil	...
Pingelly ...	Nil	...	Nil	...
Marradong ...	16	2	Nil	...
Bannister ...	...	...	...	...

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
South-West—*contd.*				
Narrogin ...	8	1	Nil	...
Wickepin ...	Nil	...	2	1
South-West Division (Southern Part):				
Bunbury ...	32	3	4	1
Collie	27	1	10	3
Salvation Army Settlement	38	2	10	3
Glen Mervyn ...	13	2	19	3
Dardanup ...	54	2	7	2
Donnybrook ...	73	2	16	3
Boyanup ...	49	3	8	2
Busselton ...	6	3	8	4
Quindalup ...	...	...	...	...
Margaret River	60	2	42	2
Lower Blackwood	Nil	...	...	...
Karridale ...	65	6	55	7
Augusta ...	32	2	22	5
Cape Leeuwin ...	40	6	28	10
Biddellia ...	43	5	...	...
The Warren ...	66	3	89	5
Lake Muir ...	32	3	45	7
Mordalup ...	20	5	24	7
Deeside	19	3	12	3
Riverside ...	16	1	48	5
Balbarup ...	20	3	31	4
Wilgarup ...	22	2	24	4
Mandalup ...	23	1	...	...
Bridgetown ...	29	2	19	3
Greenbushes ...	22	1	53	4
Williams ...	1	1	1	1
Arthur	5	3	5	2
Darkan	11	2	Nil	...
Wagin	4	1	5	2
Glencove ...	7	2	9	4
Dyliabing ...	16	2	9	4
Katanning ...	13	3	9	3
Kojonup ...	6	1	13	3
Broomehill ...	10	1	...	...
Sunnyside ...	17	2	6	2
Woodyarrup ...	14	3	95	3
Cranbrook ...	6	1	18	3
Blackwattle ...	4	1	...	...
Mt. Barker ...	29	5	38	4
Kendenup ...	22	3	26	4
St. Werburgh's	27	5	...	...

RAINFALL—*continued.*

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
SOUTH-WEST—*contd.*				
Forest Hill ...	40	6	40	5
Denmark ...	82	5	62	4
Albany	34	6	46	4
Point King ...	19	4	57	5
Breaksea ...	40	4	44	6
Wattle Hill ...	...	...	...	...
Cape Riche ...	49	2	...	...
Pallinup ...	16	4	55	4
Bremer Bay ...	81	6	43	9
Jarramongup ...	21	5	...	...
EASTERN DIVISION:				
Lake Way ...	26	4	Nil	...
Mt. Sir Samuel ...	107	3	Nil	...
Lawlers	79	4	Nil	...
Leinster G.M. ...	132	3	Nil	...
Lake Darlôt ...	72	3	...	...
Sturt Meadows...	...	...	...	...
Mt. Leonora ...	76	3	Nil	...
Mt. Malcolm ...	73	2	Nil	...
Mt. Morgan ...	136	3	Nil	...
Burtville ...	7	1	...	...
Laverton ...	11	2	Nil	...
Murrin Murrin...	73	4	Nil	...
The Granites ...	125	3	Nil	...
Tampa	96	2	...	...
Kookynie ...	44	2	Nil	...
Niagara	134	2	Nil	...
Yerilla	121	4	Nil	...
Edjudina ...	296	6	Nil	...
Menzies	308	1	Nil	...
Mulline	...	...	Nil	...
Wangine ...	...	...	...	...
Waverley ...	288	3	Nil	...
Goongarrie ...	411	4	Nil	...
Mulwarrie ...	248	4	Nil	...
Kurawa	290	5	Nil	...
Dixie Gold Mine	169	5	Nil	...
Kurnalpi ...	254	4	3	2
Bulong	194	5	Nil	...
Kanowna ...	218	6	Nil	...
Kalgoorlie ...	152	4	Nil	...
Coolgardie ...	131	3	Nil	...
Burbanks P.O. ...	167	3	Nil	...

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
EASTERN—*contd.*				
Burbanks Birthday Gift	159	3	Nil	...
Woolubar ...	329	6	...	...
Widgiemooltha...	183	3	5	1
50-Mile Tank ...	218	3	Nil	...
Norseman ...	291	4	6	1
Bulla Bulling ...	191	4	21	2
Woolgangie ...	141	2	...	...
Boorabbin ...	235	3	Nil	...
Karalee	306	2	12	2
Yellowdine ...	255	2	5	1
Southern Cross...	254	3	33	2
Mt. Jackson ...	218	2	...	...
Bodallin ...	221	2	9	1
Burracoppin ...	180	2	Nil	...
Kellerberrin ...	20	2	10	1
Mangowine ...	320	2	10	1
Wattoning ...	356	2	...	...
EUCLA DIVISION:				
Ravensthorpe ...	75	3	36	7
Coconarup ...	295	3	45	7
Hopetoun ...	68	4	49	8
Fanny's Cove ...	126	4	9	2
Park Farm ...	177	3	23	4
Esperance ...	219	6	16	...
Gibson's Soak ...	220	2	10	1
30-Mile Condenser	185	2	17	3
Swan Lagoon ...	236	5	...	...
Grass Patch ...	234	4	...	...
Myrup	315	8	33	3
Lynburn ...	235	4	16	2
Boyatup... ...	207	4	..	...
Middle Island ...	...	...	...	...
Point Malcolm ...	241	6	10	1
Israelite Bay ...	182	3	4	1
Bulbinia ...	...	...	...	...
Frazer Range ...	287	5	...	...
Balladonia ...	181	...	4	2
Southern Hills ...	272	3	...	...
Eyre	46	7	30	4
Madura	...	...	...	...
Mundrabillia ...	...	...	...	...
Eucla	34	6	36	2

The Observatory, Perth,
April 9, 1902.

W. E. COOKE,
Government Astronomer.

Return of Fruit imported into Western Australia during March, 1902.

Name of Port.	No. of Consignments Inspected.	Total No. of Cases.	No. of Cases Passed.	No. of Cases Prohibited.	No. of Cases Destroyed.	No. of Cases of														
						Apples.	Apricots.	Bananas.	Cherries.	Gooseberries.	Lemons.	Peaches.	Oranges.	Passion Fruit.	Pears.	Plums.	Rhubarb.	Pomoloes.	Pines.	All other fruits.
Fremantle ...	30	2851	2609	242	129	29	...	67	...	...	549	11	1066	...	184	701	...	...	...	2
Albany	7	184	177	7	7	24	...	...	...	...	...	7	...	...	19	126	...	...	...	1
Geraldton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	37	3035	2786	*249	136	53	...	67	...	...	549	18	1066	...	203	827	...	...	...	3

* 113 cases re-shipped to North-West Ports.

Department of Agriculture,
4th April, 1902.

Return of Fruit Trees and Plants imported into Western Australia during March, 1902.

Name of Port.	No. of Consignments of Trees or Plants.	Total No. of Trees or Plants in such Consignments.	No. of Consignments passed.	Total No. of Trees or Plants in such Consignments.	No. of Consignments of Trees or Plants prohibited.	Total No. of Trees or Plants in such Consignments.	No. of Packages dipped.	No. of Trees.															
								Ornamental and Pot Plants.	Almonds.	Apples.	Apricots.	Cherries.	Figs.	Lemons.	Limes.	Mulberries.	Oranges.	Peaches.	Pears.	Plums.	Small Fruits.	Vine Cuttings.	All other Trees.
Fremantle ...	6	6490	6	6490	...	...	6	6490	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Albany ...	1	25	1	25	...	...	1	25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Geraldton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	7	6515	7	6515	...	...	7	6515	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Department of Agriculture,
4th April, 1902.

By Authority: Wm. Alfred Watson, Government Printer, Perth.

JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA.

Vol. 5.—Part 5.

MAY, 1902.

PERTH:
BY AUTHORITY: WM. ALFRED WATSON, GOVERNMENT PRINTER.

1902.

NOTES.

How to tell Fresh Eggs.—The following method of determining the age of eggs is said to be practised in the markets of Paris:—About 6oz. of common cooking salt is put into a large glass, which is then filled with water. When the salt is in solution an egg is dropped into the glass. If the egg is only one day old it immediately sinks to the bottom; if any older it does not reach the bottom of the glass. If three days old it sinks only just below the surface; from five days upwards it floats.

Whitewash.—We frequently publish whitewash recipes, and the number of requests which we receive to publish between times leads us to suggest that our readers cut this out and preserve it. The following recipes are all from the Scientific American:—"Take half a bushel of freshly-burnt lime; slake with boiling water, covering during the process; strain through a fine sieve and add seven pounds of salt, previously dissolved in warm water, three pounds rice flour boiled to a thin paste and stirred in boiling hot, half a pound powdered Spanish whiting and one pound of glue, previously dissolved in the usual way. Add five gallons hot water, stir well and let it stand for a few days covered from the dirt. This wash must be applied hot. About one pint will cover a square yard. Another whitewash, not so good as the foregoing, but which will not rub off, is made by mixing half a pint of flour with water and thickening with boiling water. Pour, while hot, into a pailful of lime slaked with boiling water and stir well. All lime for whitewash should be fresh and slaked with boiling water. If a good job is desired it must be strained. Another recipe: Slake one-quarter bushel lime and add one-half pound salt, one-quarter pound sulphate of zinc and two quarts sweet milk. Dissolve the salt and the sulphate of zinc before adding. Add water as required. This wash should be used when made."

Blow Flies and Sore Eyes in Sheep.—A writer to the *Agricultural Journal*, Cape Colony, says:—"To prevent blue-bottle flies from 'blowing' sheep, wash out the wounds clean with diluted carbolic mixture, and then dust in iodoform powder. This is best done by using a small insufflator (such as are sold for use with Keating's insect powders), and blowing the powder into the wound. I always use two of these; one for iodoform powder and the other for boracic powder. The latter I always find most useful for treating sheep with sore eyes. In cases where the film on the eyes becomes very persistent, a little calomel, blown into the eyes, often acts when other dressings fail."

Water Reservation.—The recent severe dry weather renders the subject of irrigation very appropriate, and forcibly reminds all

those who cultivate the soil of the necessity of water conservation. By the aid of a few dams, which might be made on almost any farm or homestead, a very large quantity of water could be conserved in the rainy season to last through the dry portions of the year. There are homesteads in the Northam and York districts through portions of which the Avon river runs; the holders, however, suffer nearly every year for the want of a sufficient water supply; yet all that is required is to ram in a few posts across the river bed in the dry season, and, with the aid of some good clay and stones, a dam could be made of such dimensions that there would be no fear of any future want of water. This also applies to many other places in the South-Western districts; at the worst there is hardly a place that does not possess a creek or a sufficient undulation of the ground that could be turned into a receptacle for storing water.

Spaying Cattle.—Although spaying cattle may not be quite all it was once held to be, it undoubtedly is a useful operation in certain cases. In Victoria they have been sailing in for this system with a vengeance. Since his appointment as Government cattle-spaying expert, about 18 months ago, Mr. David Wilson has operated on 3,423 head, has given 291 practical exhibitions, and instructed 230 stockowners in the art of spaying. Altogether, over 6,000 farmers have attended the exhibitions given by Mr. Wilson, and the interest in the work he is carrying out is steadily increasing. The percentage of losses is very small, not exceeding ½ per cent. on the total number of cattle operated on. The popularity of the work he is engaged upon is shown by large numbers of applications reaching the Department of Agriculture, asking that he should visit different districts. In addition to spaying, Mr. Wilson gives practical demonstrations in the new system of castration of horses, by means of which the cruel practice of "searing" is dispensed with. He also explains the operation of the duplex lancet probe, an instrument successfully being used for removing the obstruction in the teats of cows that are "tough" to milk, thereby causing the cows to afterwards milk comparatively freely.—*Station, Farm, and Garden*.

How to Pack Trees for Shipment.—All trees intended for long journeys must be thoroughly defoliated and hardened. Trees should be taken up without mutilating the roots, and no branches or roots cut. Puddle the entire tree in stiff clay, allow it to dry, and pack in tight cases lined with thick paper. Use dry moss and charcoal and pack the cases very tight. We also find that it is not judicious to use packing cases larger than 2 feet by 10 feet. Packed in the above manner, we have had stock in transit over four months and 90 per cent. of it grew after planting. Another writer states:—The best preparation used for coating trees which are to be sent out of this country is a thin liquid mud. This is applied to all kinds of trees and some kinds of cuttings that are shipped across the

ocean, and appears to be generally successful. In shipping tender cuttings, the ends are frequently waxed with melted paraffin or grafting wax and wrapped in tinfoil to prevent their drying out. For ordinary deciduous trees that do not cross the equator, nothing more than the ordinary packing moss about the roots and straw about the tops are considered necessary.

Douglas Mixture.—Those who wish to keep their fowls hearty and healthy will do well to use Douglas Mixture two or three times each week in the drinking water. It gives vigour to the birds and tones the system, assisting to ward off croup and other diseases which are very prevalent at this season of the year. Directions: To one gallon of soft water add $\frac{1}{2}$lb. of sulphate of iron; when dissolved, add $\frac{1}{2}$oz. of sulphuric acid. Bottle up and cork tightly. This mixture should be given to laying fowls and growing chickens two or three times a week. Dose: One tablespoonful to a quart of water.

To Test whether a Cow is in Calf.—A correspondent in *Queensland Country Life* tells of a test he uses to determine whether his cows are in calf or not. We should like to hear from anybody who uses the test. He says:—"The cow to be tested is, of course, milked separately, and as soon as possible after the milk is drawn we dip a straw or Timothy stem in the bucket of milk. Have a glass of pure water at hand, and allow one drop of the milk to fall in the water—only one; if the milk quickly dissipates and renders the water murky, she is not in calf, but if the milk drop sinks to the bottom of the glass before mixing with the water she is pregnant. If you are not sufficiently expert, take the milk of another cow that has newly calved, and pursue the same treatment with both at the same time, and you will not fail to note the difference in the way the drop of milk will mix with the water. I have practised this method of determining pregnancy in my herd for years, and I never knew it to fail. Of course, I only speak from my own experience, but the theory is that the milk of a pregnant cow is viscous, or has a sticky, adhesive quality that causes the particles to cohere more closely, consequently the tendency to drop in a mass instead of mingling immediately with the water. I usually take the morning's milk for the test, and use cistern or rain water if you have it, or, better still, filtered or boiled water."

Soy Beans.—We have received during the week a very fine sample plant of the Soy bean grown by Mr. A. Chester, of West Swan. This plant is a very heavy seeder, the plant in question having 321 pods, each containing two to three seeds. The Soy bean is of a highly nutritive value, and is especially valuable for pig feed, either in its green state or as a dry bean. It is well worthy of cultivation by the agriculturists of this State.

THE INSECTIVOROUS BIRDS OF WESTERN AUSTRALIA.

By Robert Hall.

Letter-winged Kite.

Elanus scriptus, Gld. *(El'a-nus ; skrip'tus.)*

Elanus, a genus of birds; *scriptus*, (p.p.) write.

Elanus scriptus, Gould, "Birds of Australia," fol., vol. i., pl. 24; "Key to the Birds of Australia," Hall, p. 2 (1899).

Geographical Distribution.—Areas, 9, 7, 6, 4, 3.

Key to the Species.—Plumage, greyish white; axillaries and the broad bar across the under wing-coverts black, appearing to form the letter V; cere and legs, yellow.

The conspicuous black band of the wing in contrast to the silvery grey of the trunk makes this species a very pretty one when on the wing. It soars high and appears to "hawk" for insects. It certainly does so among the highest branches of eucalyptus. It is a semi-insectivorous bird partly owing to the feeble bill and legs. Birds of prey, truly answering to their names, must be strong in these regions.

The disposition of the present species is to perch in the dead limbs of high trees or among the higher branches rather than spend much of its time upon or near the ground.

Associated sometimes with the species is a second one and the only other of the genus. It is the Black-shouldered Kite, *E. axillaris.* Lath., and may be distinguished from *E. scriptus* by having a black shoulder, but its axillaries white. In other words there is not nearly so much black upon the wings or adjacent to them.

Nest.—Open, composed of twigs, and internally lined with fibres and small twigs.

Eggs.—Three or four to a sitting; ground colour, mostly white, smeared with blotches of a dull rusty colour. Length, 1·5 inches; breadth, 1·2 inches.

Marbled Owl.

(Western Boobook ; Brown Owl.)

Ninox Ocellata, Homb. and Jacq. (Sub. sp. of N. Boobook, Ni'noks os-el-a'ta.)

Ninox Ocellata—Preserved Specimens, Victoria Museum, Perth.

Geographical Distribution—Areas 9, 8, 7, 1.

Key to the Sub-species.—General colour, rufous; interscapulum not spotted, wing 9·3 inches, tarsus not twice the length of middle toe; facial disc unequal, the part below the eyes much larger than the part above; outer toe reversible.

This sub-species is a more plentiful bird in our State than the species *N. boobook*, Lath. It is the Western representative of the

Eastern form, being more rufous, and slightly shorter in the wing (one inch). Of all the Owls this is the best known, and, possibly, the most useful of them. In nature it plays a wonderful part, silent and unobtrusive, yet performing its avocation surely and perseveringly. When we consider that there are some 765 species of birds in Australia, and only, say, two dozen able to do the night work of checking the ravages of insects or other animals, we should see that a careful preservation of all be strictly enforced. The late Mr. Gould remarked, "In no other country is there a greater proportion of insectivorous birds than in ours, and certainly none in which nocturnal species, such as the *Podargi* (Frogmouths) are more numerous." It is clear to me the continent needs them, and it is for you to help to keep, as well as possible, this balance. Owls

Marbled Owl.

about your haystack are a safeguard against night-flying insects and the depositing of their ova. The Powerful Owl (*N. strenua*) of the Eastern portions of the continent, is possibly the only species that regularly kills small birds. The others have a varied diet—small insects and small quadrupeds. *Ninox boobook* eats insects of various orders, principally locusts and other *neuroptera*, as noted by Mr. Gould. Occasionally a small bird is captured. The Owls of this continent are divided into two families. Two noticeable features keep them quite separate. The first, that the "wishing-bone," or *furcula*, is not attached to the breast bone (*sternum*), and the middle toe is not serrated as in the *Bubonidae*; and the second, that the *furcula* is attached to the *sternum*, and the middle toe (claw) is

found to be serrated. The two families include 13 species and two sub-species. Our largest owl measures 2ft. in length, the smallest 13 inches. Certain of them keep to heavily timbered country, others to the sparsely-wooded lands. All breed in hollows and lay white eggs.

The call of this species is "boo-book" or "more-pork." It is the owl that calls "more-pork" and not the bird we know as "More-pork" or "Frogmouth."

Nest.—A hollow of a tree with decayed wood for the eggs to rest upon.

Eggs.—Three to a sitting; white and finely pitted. Length, 1·5 inches; breadth, 1·2 inches.

Raven.

Corone Australis, Gld. (Ko-ro'ne as-tra'lis).

Korone, a raven; *Australis*, southern.

Corone Australis, mounted specimen, Victoria Museum, Perth.

Geographical Distribution.—The whole of Australia and Tasmania.

Key to the Species.—Plumage, uniform blue-black: base of feathers, dusky brown or black, not snow white; first primary longer than ordinary secondaries, but shorter than the innermost secondaries; hallux, very strong.

The Raven is undoubtedly the most commonly seen bird in nearly all Australia, excepting in the towns and suburbs.

No homestead exists in the country which is not visited by Ravens; indeed, hardly a traveller can camp for the night but his tent and fire are discovered by this keen-sighted bird. In fact, he may well be said to be the bird most knowing and most gifted with reasoning powers we have in the colonies, and we have some of great intellectual ability.

It is not so prominent a bird in South-West Australia, and appears here to be represented by the Crow. The Raven has a greater historical interest than the geese which saved the Roman capital. In size, "the largest Raven is the greatest of the Passerine order." According to leading anatomists it is probably the most highly developed of all birds. A friend's letter to me, dated 10th April, 1898, contains a valuable contribution to the knowledge of the sagacity of the Raven, and a non-sensitiveness about the gastric region.

They seem to be able to swallow a thing and regurgitate it at pleasure. "The Messrs. Cheriton, who reside at Mossgiel, New South Wales, have a pet Raven and a Magpie. The Raven would eat till it had enough, and then swallow more, retire, and disgorge it in some hiding-place. If, while it was hiding the food, the Magpie was seen to be watching, it would immediately re-swallow it and go to some other place. It was noticed to do this when the Magpie was in close attendance, and as the bird could find nowhere to go, it retired under the dress of a lady, and deposited the food

there. On another day a flock of Ravens were being invited to sup from a poisoned carcass. Having a secret watch put upon them, one or two swallowed pieces, and were noticed to quickly disgorge the strychnined morsels as if they knew something was amiss. Whether from taste, intuition, or previous experience they did this I cannot say." If the Raven is an eater of dead matter it is also predaceous to a most useful extent; for it considerably reduces the *cicadæ* (so-called locusts), and thereby lessens their now well-known ravages at the roots of fruit trees. Both Crows and Ravens (as we term our once so-called crows) give chase to the "seventeen-year-old insects," and having captured one while on the wing the bird settles upon a tree, holds it in one set of claws, sucks the juices from the trunk of the animal, and then drops it to the ground, still alive. This manner of living goes on at different parts of the colony during the spring season, and perhaps later. After a bush fire they feed very largely on insects, half-roasted quail, etc. In writing of the nesting of the Crow, Mr. L. D. Cameron sends me the following note from the interior of New South Wales:—

"I found the nest of a raven in September, 1896, containing four young birds. It was on the ground, and at least 200 yards from any timber. The nest was built just as usual, but was flat on the ground. I have heard of other nests in our district on or very close to the ground, but have only seen one myself. The country referred to is most miserably timbered, and I do not believe two pairs of crows would agree to have their houses up the same stunted tree." With regard to further anomalies, I have seen clutches of eggs uniformly blue, and at other times to consist of one hard-sat egg. One specimen of a bird had a white head (South Australia).

The sail area of the Raven in relation to its total weight is as large as that of any bird (observation of Mullenhoff). Because of the highly-developed larynx, it is placed by Dr. R. B. Sharpe among the singing birds. I venture to think a little voice education would do much good in this case, and probably efface the heavy blot of prejudice against it.

Nest.—An open, bulky structure placed high or low in a tree, and composed of sticks and twigs and lined slightly with softer material.

Eggs.—Four or five to a sitting; greenish appearance with blackish-brown or brown spots and blotches. Length, 1·5in.; breadth, 1in.

White-winged Butcher-bird (Whistling Jack).

Cracticus leucopterus; *Gld.* (*Krak'ti-kus lu-kop'te-rus*).

Kraktikos, noisy; *leukos*, white, *pteron*, a wing.

Cracticus leucopterus, Gould, preserved specimen the Victoria Museum, Perth.

Geographical Distribution—Area 9.

Key to the Species.—Adult male: Throat white, back bluish grey; flanks brownish; sides of upper breast grey, contrasting with head which is deep black; bill strong and well hooked; nostrils longitudinal slits about midway between base and tip of bill. Female less prominently marked than the male.

I incline to the belief that most of us know the Butcher-bird. But there are two species in our State which are specifically different, though so much alike in colour, form and habit that their purposes appear to be equally well served as if both were one. The second species, found in most places, is known as the common Butcher-bird (*C. destructor; Temm*). Its distribution is over the continent, excepting the North-West, while the present species is confined to the West. The amount of white on the wing is no sure guarantee. The greyish white flanks of *C. leucopterus*. Altogether nine Butcher-birds are found in Australia. The present species and the one already named are the most common of the *genus*. *C. nigrigularis* occurs on the Fitzroy River in the North. The magpie is the nearest relation to the Butcher-bird, but one is much more insectivorous than the other. When named *Lanius* in the

first meeting, it was well called so, as it is a true butcher in so far as it hangs up little birds (silver-eyes), etc., within forked branches and proceeds to dismember them, one at a time, to satisfy its appetite. At a later date the generic name was changed to *Cracticus* (noisy). This not only indicated one means of recognizing the bird, but in addition removed the delicate subject of bird destroyer from it. That was well, because vermin and beetles form a very large portion of its food. In autumn the bird is garrulous, and has a musical and rich liquid note. That Butcher-birds are pugnacious is quite evident to me. I know of three that tried to fight their shadows in water and finally got drowned. I am sorry to say so, but this bird is rather fond of stealing canaries when it is making its autumn tour of the outskirts of suburbs. In a few words, it pounces upon the cage, disconcerts the domesticated bird, and subsequently gets it out, piecemeal if not whole. I have the knowledge of at least a dozen cases, though I say so without prejudice because of its other good qualities.

Nest.—Cup-shaped, made of twigs and lined with grasses or rootlets. Placed in a tree.

Eggs.—Three or four to a sitting; the ground colour may be olive green or tawny brown, spotted with dull chestnut and nondescript black. Length 1·2 inches; breadth 1 inch.

THE IMPERIAL INSTITUTE.

A new city branch of the Imperial Institute will be opened early in May for the display to merchants, manufacturers, etc., of raw and manufactured products received from time to time from the Colonies and from India, and for which it is desired to find openings in the British markets. Curators, and other members of the Imperial Institute staff, will attend at the office, at stated times and by special appointment, to deal with inquiries and to assist in establishing or facilitating business relations with mercantile houses, etc., in the Colonies and in India. The city branch will be in constant communication, by telephone and messengers, with the Imperial Institute, South Kensington.—*Nature*, 27th March, 1902.

NOTES ON SEEDING AND PLANTING.

PERCY G. WICKEN.

Now that the season of the year is at hand in which a large amount of seed-sowing takes place, a few simple hints or instructions as to the best methods of sowing may be acceptable. A very common mistake is often made by sowing the seed too deep, and after germination the young shoot is unable to reach the surface, and the seed is blamed as being too old. As a general rule, a seed should be planted about twice its own depth in the soil. With the larger and more vigorous-growing plants, such as beans and peas, etc., the question of depth is not of so much consequence; they will be able to force their way through, but with grass and other light seeds the question of depth is very important. I have carried out a series of experiments in sowing wheat at various depths, every half-inch from one to eight inches. The grains sown at two inches deep, took 10 days to appear above the ground, and the percentage of seed germinated was 74; that sown at 8 inches deep took 24 days to appear above the ground, and the percentage of germination was only eight, while at harvest time the yield from those sown at two inches was 149oz., that from those planted eight inches deep was only $1\frac{1}{2}$oz. This tends to show that sowing the seed too deep affects not only the percentage of seed which germinates, but also has a detrimental effect on the small number of plants which survive.

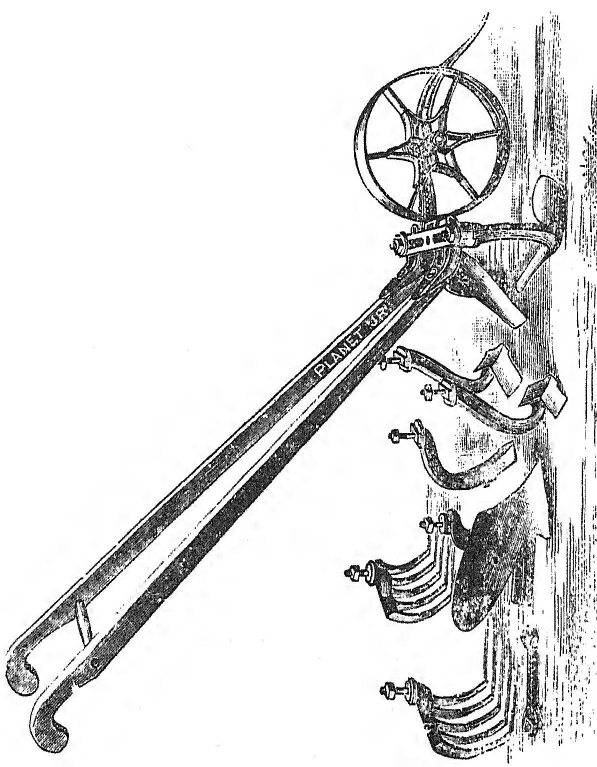
Another point which must be remembered is the mechanical condition of the soil. Seeds can be sown much deeper in a light sandy soil than in a heavy clay. Many people sow seeds while the soil is in such a rough state that favourable results can hardly be expected. Too much prominence cannot be given to the fact that a fine tilth is absolutely necessary if success is to be obtained. The land, whether on a large or small scale, requires to be well worked up by cultivating, harrowing, and rolling before sowing seed. The rougher the land is the greater is the quantity of seed required, and it will be found more profitable to use a smaller quantity of seed and to spend the extra money in cultivating the land, as the crop derives the benefit of the extra cultivating. In wheat sowing, for instance, on well-prepared land one-half to three-quarters of a bushel of wheat is ample; whereas on rough and lumpy ground as high as two bushels is often sown.

Some seeds, such as onion, do better on land that has been well rolled and made as firm as possible. Others do better sown on loose ground and just covered. Others again, such as tobacco, require special preparation of the seed-beds before sowing.

In most cases it is advisable to sow seed in drills. The advantages of this are that more light and air are enabled to get to the plants when up. The seeds can be sown more evenly and at a

regular depth, and also that the space between the rows can be kept free from weeds by means of the horse or hand hoe.

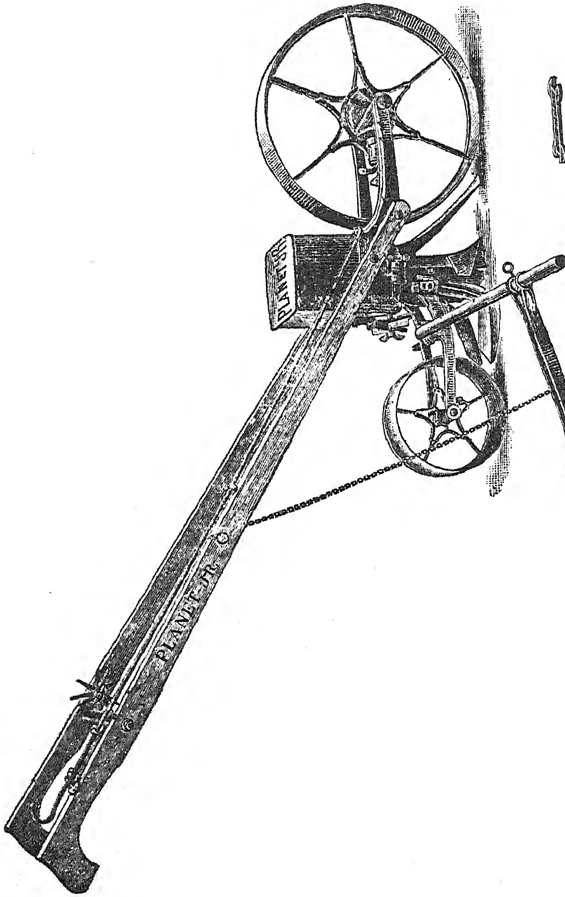
There are many ways in which drills can be made quickly ; the usual way is to use a line, and to mark out the drill to the requisite depth by the side of the line with a heart-shaped hoe—this is a capital little tool for the purpose. Another way, which I have often tried, is to open out a number of drills at one time by means of a home-made implement something after the fashion of a hay rake. This can be easily constructed by taking a piece of 3-inch by 2-inch timber, nailing a handle to it, and boring holes in the wood at the distance you require your drills apart, and putting in a wooden tooth, so shaped as to make a broad or narrow drill as required. This drawn over the ground will mark out several drills at one time. Where there is a considerable sized garden, a Planet, jun., hand-drill and cultivator will be found very useful. This



Planet, Jun., Single Wheel Hand Cultivator.

implement has a number of attachments, by means of which a drill can be struck out or filled in as required, and they are also useful for cultivating between the rows. Another machine is also made

which has a seed-sowing attachment which opens up the drill, sows the seeds, closes up the drills, rolls the surface, and marks out the



Planet, Jun., Combined Seed Drill and Cultivator.

line for the next drill, all in one operation. They are light to handle, the price is reasonable, and no one having a good-sized garden can afford to be without one of these useful machines. On light and loose sandy soils the seeds are all the better for being well pressed or trodden into the soil by walking along the drill after filling in. This enables the young plants to obtain a better root-hold; but in a stiff, clayey, or wet soil the seed only requires to be covered lightly; and if the drill is just filled in with a rake, this will be sufficient.

As to the distance the drills should be placed apart, this, of course, depends on the variety of plant, and also on the richness of

the soil. In a good rich soil, in which the plants are likely to grow to a good size, they require to be further apart than in a poor soil, in which the plants are only likely to be small. It is a mistake to overcrowd plants, and, whether planted out direct in the field and afterwards thinned, or the young plants transplanted out from seed-beds, sufficient space should be left to enable the roots of the plant to obtain a full supply of food and moisture; and also so as to allow sufficient space to cultivate between the rows. Some plants, such as beets, carrots, parsnips, or turnips, may be sown rather thickly, and the young plants gradually thinned out as they obtain any size and used for table as required, thereby leaving an increased space for the full crop as they mature. It is generally better to give a little too much space than to put the plants too close. In planting out young plants from the seed-bed, it is always well to select strong, sturdy-growing plants. All spindly and weak-growing ones should be rejected, as their growth is never satisfactory, and the space they occupy can be filled more profitably. Seed in the seed-bed should not be sown too thickly, as this is the cause of weak plants. If the plants come up too close they should be thinned out as early as it is possible to do so. In warm districts, where it is necessary to shelter seed-beds in the early stages of growth, the covers or shade should be gradually removed, if only for a few hours every day at first, increasing the time every day until before planting out into the field the plants should have become hardy enough to stand exposure to the sun. A mistake is often made of planting seedlings out from a bed that has been sheltered from the sun into the garden, where they are exposed to the full heat, and consequently wilt and die. In removing young plants from the seed-bed, care must be taken to lift a small quantity of earth with each root; and in planting out in their new home the roots should be placed in the same position as that in which they were growing previous to being transplanted. It is no unusual sight to see people putting out seedlings in which the roots are placed into the ground in any manner, and if the root happens to be rather long the end is often doubled up and left sticking out of the ground. Such carelessness deserves no better fate than is sure to be awarded to it in the poorness or failure of the crop.

Flower seeds require to be sown thickly and lightly covered with soil. On light loams or sandy soils the seeds will germinate freely, provided there is a liberal supply of moisture; but on clayey or stiff soils it is better to dig in a quantity of compost and sand. This makes the soil much more friable, and enables the plants to make much better growth. The extra trouble will be well repaid by the appearance of the blooms in the flowering season. Valuable plants, and indeed most flower seeds, are sown in earthenware pots or boxes, and kept in these for some time previous to planting out in the open. These pots or boxes must be well drained, and should be filled with a well-mixed compost, composed of old, well-rotted manure, good mellow soil, and sand in equal proportions. This should be pressed down firmly in the pot, the seed sown on the surface, and covered by a thin layer of the same mixture sprinkled over the seed.

The plants should be removed from the pots, and planted out into the garden when sufficiently grown. A dull day should be selected for this operation, and if the weather is at all hot a piece of bark or old shingle should be used to shade the plant until established in the soil. A very handy way to raise young seedlings is to use short lengths of bamboo cane; either obtain hollow canes or remove the pith, fill the centre with soil as previously mentioned, and sow the seed on top. When planting-out time arrives this cane may be put in the ground as it is, without removing the plant. The cane will soon rot and the roots will then spread out. This method enables the seedlings to be planted out without disturbing the roots. This method is also of advantage if the seedlings have to be sent any distance before transplanting.

INSECT PESTS AND PARASITES.

REPORT BY G. COMPERE.

The Director of Agriculture has received the following report from Mr. G. Compere, entomologist, who is at present in the Eastern States searching for parasites of our most troublesome pests:—

"Owing to the severe drought which has prevailed throughout New South Wales for the past seven months, which will have the effect of shortening the coming crop of citrus fruits to a great extent, high prices are looked forward to for whatever oranges and mandarins that there are on the trees. In a few localities, where local showers have fallen, the trees look remarkably well, considering what they have gone through; while in other districts they have a very dry and parched appearance, and this, too, in places where cultivation is carried on under the most advantageous conditions.

"The late summer fruits have this year, in most sections of the State, been a complete failure, not alone on account of the drought, but in consequence of the ravages of fruit-flies, which in some localities destroyed the entire crop. A number of growers have informed me that it will not be worth their while attempting to grow any variety of summer fruit that must remain on the trees later than the month of February, as that is about the time the flies make their appearance. This season they have attacked the persimmons, all kinds of late peaches, oranges, and mandarins. There are two species of fruit-fly to be found here, one the same as occurs in the West, and the other the so-called Queensland form. There is, apparently, no restriction placed upon the sale of infested fruit, and in the majority of orchards no attempt is made to destroy the maggoty fruit that has fallen to the ground, thus

giving the flies full sway, and has made the price of late summer fruits go as high here as they are at Perth or Fremantle at the present time. This has opened up a good market here in New South Wales for Victorian and South Australian fruits. Tasmania is also well and favourably represented in the local fruit stores with apples; not that good apples cannot be grown in this State, but the codlin moth, like the fruit-fly, does pretty much as it pleases. Choice apples and pears are now retailing, in the city of Sydney, from 2s. 6d. to 5s. per dozen.

"It is a well-recognised fact among fruit-growers here that unless the State Government soon adopt some systematic method of ridding this State of some of its noxious insect pests, fruit-growing for profit will in a few more years become one of the has beens. What method, if any, that will eventually be adopted remains to be seen, as very few of the old pioneer growers think it worth while going back to the old compulsory system of spraying, that as it has to be done every season, that after paying freight charges and the commission men for the sale and handling of their fruit, there is nothing or very little left for the grower.

"The red scale is also a very serious pest here in the citrus orchards of New South Wales. Any number of orchards look as if a fire had passed over one side of the trees, while the lemons that are to be noticed on sale in the local fruit stores are so thickly covered with the scale that they do not resemble lemons.

"A very good illustration of the useless attempts to exterminate insect pests by artificial methods after they have once become established in a new country is furnished by the State of Massachusetts, U.S.A. In 1869, Professor L. Trouvelot, a naturalist and astronomer, and at that time connected with the astronomical observatory at Harvard University, for his own pleasure and interest, was engaged in the study of wild forms of silk-worms, with the idea that species of commercial value might be found. In the course of this work he imported from Europe living specimens of different silk-spinning caterpillars in different stages of existence. And among others live egg clusters of the Gipsy Moth, and these, after hatching, made their escape, and in a few seasons increased to such an extent that they became a notorious pest, destroying the foliage of every variety of native plants and trees, as well as introduced species, and in order to save the extensive forests of that State, the State Government soon took the matter in hand, and million upon top of millions of dollars were expended by that State in trying to eradicate it. As much as a quarter of a million dollars were expended in a single season, and now, after 30 years' hard fighting, that State has given up the fight. In a letter received by the writer a few days ago, dated 3rd February, written by the Chief of the Division of Entomology, Department of Agriculture, Washington, D.C., U.S.A., Dr. L. O. Howard mentions the fact that the moth is now spreading rapidly, and adds that he is now trying to secure its natural enemies from Europe.

"Now that Massachusetts has given up the fight, this moth will soon spread to all the adjoining States, and become a national question. It is one of the most serious insect pests which the Americans will have to contend against, as it not only defoliates the fruit trees and garden plants, but forest trees as well. It has often been pointed out to the officers who had charge of the extermination of the pest in the State of Massachusetts, where the natural enemies of it could be secured; but as the introduction of those agents would mean that a small army of political men would be thrown out of employment, no attention was paid to the suggestions. But now that the national Government will have to take the matter in hand, and as the Chief Etomologist of the Department of Agriculture, Dr. L. O. Howard, knows where the natural enemies are to be found, it is to be hoped that he will be furnished with funds to obtain them. When that has been accomplished, it will have the effect of opening the eyes of the world to the blind manner in which they have been fighting the various insect pests in the past, and will hasten what the writer predicted in the November number of the *Journal*, that it will not be many years before the fighting of insect pests by artificial methods would become a thing of the past."

LAYING OUT THE GROUND.

A. Despeissis.

With the advent of the winter and rainy season numerous young orchards and vineyards will spring into existence, whilst many of the older established ones will be added to. A few notes touching on the question of plotting out the ground for planting will therefore prove seasonable. Ploughing, scarifying, harrowing, and other tillage operations, as well as spraying of the trees and picking of the fruit are made easier if a vineyard or orchard be planted according to a symmetrical plan. By having the trees or vines in perfectly straight rows, time is saved in cultivating and much accidental injury to the trees avoided.

After the land has been cleared, ploughed, and harrowed, the laying out of the ground is the next thing to attend to.

Several methods are adopted in this respect:—1° the square, 2° the diagonal, 3° the hexagonal or equilateral or septuple, 4° the quincunx.

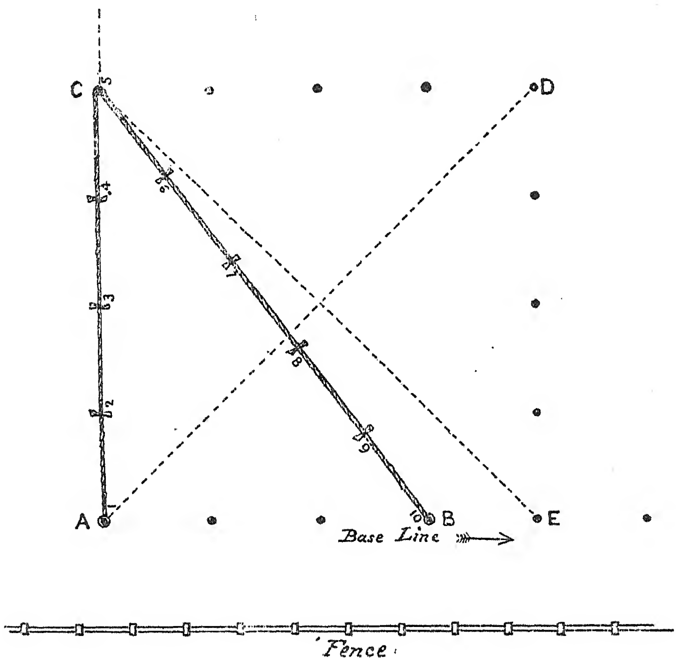
For planting a large orchard or vineyard on undulating land, it is advisable to set off the land with a theodolite, or employ a surveyor to do the work, so as to ensure precision. There are,

however, simple methods of carrying out this work which anyone can follow, and which rest on geometrically accurate propositions.

In any case it is essential to start from a *base line.*

A surveyed line for this purpose is generally to be found alongside the field of operations, as roads and boundaries are everywhere to be found.

1°, *Square* planting, seems the simplest plan of laying out an orchard, but it will be seen that the others are just as easy.

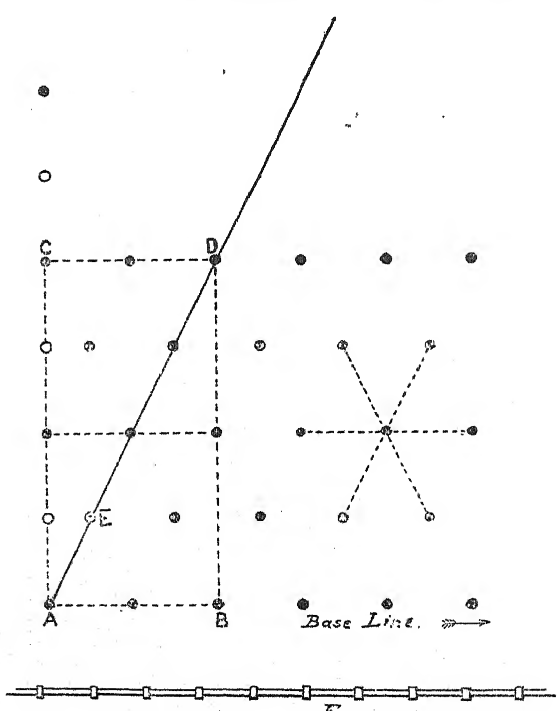


In the first instance, the base line having been traced, which can be done by measuring the width of a prospected roadway from, say, a line of fence to the intending first row of trees or vines, pegs are set in the ground, so that the two lines, fence, and row of trees are parallel. A roadway of 18 to 20 feet is all that is necessary to allow the horses and implements to turn at the headland. On this line, as a base line, the next thing to do is to figure out a right angle corner, and the following way of doing this is mathematically correct:—First, along the base line of the given piece of ground we may imagine it is purposed to put under vines, at distances of 10 feet square, measure with the tape three intervals of 10 feet each, putting pegs at each distance. Then having secured a flexible line, such as picture wire, marked off into nine or more 10-feet intervals by means of string or strips of calico; set one end of that line at the

corner peg A, where the first vine is going to be planted, then stretch it as correctly as guesswork will permit in a direction perpendicular, or at right angle to the base line, and at the fifth mark which shows the fourth interval drive down a peg; round this peg turn your wire, and bring it to the peg B, driven at the third interval along the base line. If the mark along the measuring line meets the peg B along the base line A, E, then the angle B, A, C is a right angle, if it does not, shift peg C until the 10th mark or the end of the ninth interval along the measuring line connects with peg B on the base line. It is mathematically true that in every instance when the three sides of a triangle are as 3, 4, and 5, the angle opposite the longest side or hypotenuse is a right-angled triangle.

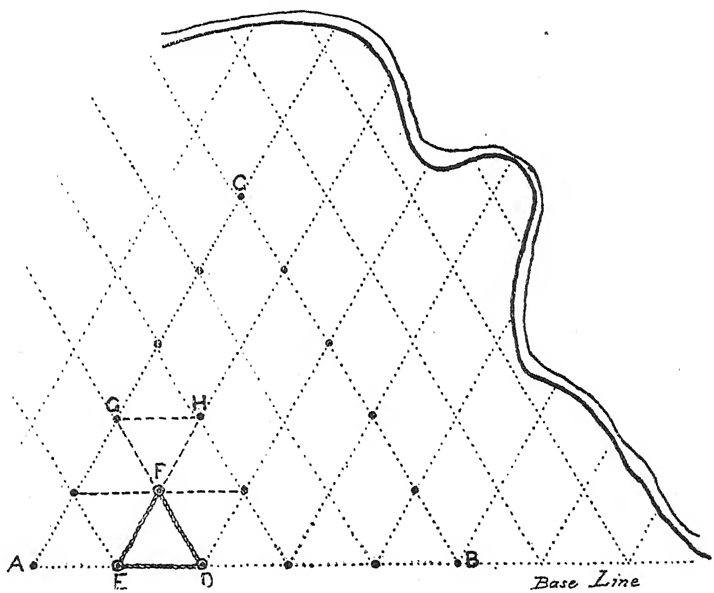
Another method, which may be used as an alternative, consists in guessing a triangle and measuring the diagonal distances between the opposite corners A, D, and E, C on the figure, unless those distances are equal to a fraction of an inch, the square is not perfect, and by manipulating and shifting the pegs until those two lengths coincide the desired lines running at right angles to one another can be planned out.

2° *Diagonal* planting has few, if any, advantages. As shown in figure 2, the base line is first determined and a true corner found as



in the case of the square. On the lines thus determined rows of trees will be set. The alternate rows are obtained by running with a line a diagonal from *two* squares which have already been mapped out. From the corner A, mark off one-fourth distance along this diagonal and you have the spot where the first tree along the second row will stand; from these points plot out parallel lines to A B, A C, etc., and along these lines mark off the required distances as had already been done on the base lines.

3° *Hexagonal, Equilateral,* or *Septuple* planting, so called because seven trees enter into its figure; which consists of six trees—disposed after the figure of the cells of the honeycomb—



or hexagon, and enclosing a seventh tree. The term equilateral is due to the fact that each tree is equidistant from any other tree around it. By this method of planting less ground is wasted, and while the roots of every tree has theoretically the same amount of ground to feed on, assuming that the roots spread evenly round the stem, it is at the same time possible to pack fifteen per cent. more trees to the acre by this method as compared with square planting.

The hexagonal is as easy a method of plotting a piece of ground as is the square, and I have found it even easier than that latter method whenever an irregular piece of ground has to be planted.

By this arrangement, the space not only is more fully occupied than by any other, but, moreover, cultivation can be carried out in three different directions.

To find the number of trees to the acre when planted on the septuple system, find out the number given by the square system and add 15 per cent. to it.

Various ways lend themselves to setting to work and laying out an orchard according to the septuple system, but the following is one which commends itselt for its simplicity.

Determine the base line; peg along it a few equal spaces it is desired to plant the trees at, say, for argument's sake, five intervals of 22 feet each, the distance between A and B along the base line is thus 110 feet; one end of two lines also 110 feet each are fastened at the pegs A and B and are drawn together taut until the other two ends meet at C. Along the lines A C and B C mark off likewise five intervals of 22 feet each, and fill in the triangle as shown on the figure. Once the equilateral triangle is set, the lines are prolonged to whatever limit it is intended to reach, and wherein they intersect pegs are put in. Be the piece of land regular, or the boundaries irregular, as happens, for instance, when a vineyard or an orchard are planted on a river bank, the rows will all be in symmetrical lines. An easy method of laying out hexagonals with a triangle is also shown on the above figure. Three pieces of flexible wire, such as light clothes lines, are cut to precisely the same lengths, their ends are spliced to rings two inches to two and a-half inches in diameter as shown in the above figure—the sides E D, D F, and F E are equal. Place one of the sides, say E D, along the base line, and drive pegs at E and D; stretch the third angle until the other two sides of the triangle are taut, and drive likewise a peg through the ring. Then round the peg F as a centre, revolve the triangle right round, stretch the side lines taut, and drive short pegs straight down through the centre of the rings at G and H. Next move the wire triangle to the next distance and do likewise, repeating the operation until the end of the row is reached. In this way, a man and two assistants can mark out three rows with the greatest accuracy, provided that they always ascertain before driving the peg into the ground that the lines are reasonably tight; on flat, even ground the triangle can be stretched flat on the surface of the ploughed land; but on sloping ground a little levelling is required, the triangle being stretched as nearly horizontal as possible by raising one or two corners as required, and a stake driven down plumb to the right spot.

The *Quincunx* is a method involving groups of five trees, the fifth tree occupying the centre of a square. It is only useful where long lived and slow growing trees are planted, when it may be desirable to set amongst them some quick growing trees, such as peaches, nectarines, or Japanese plums, which will begin bearing early and can be cut down to make room for the longer lived trees, when after ten or twelve years their period of usefulness is on the wane. For laying out this system squares are first lined, then diagonal lines are drawn from opposite corners of the square and a peg driven down at the intersection.

Marking off with light wire lines, No. 12 gauge or light clothes wire gives more accurate results and answers for laying out either squares, quincunx, or rectangles. Wire lines are preferable to string, because they don't shrink or stretch. A wire line 209 feet long (a trifle over three chains) will form the side of a one acre block. At each end fasten an iron ring two or three inches in diameter for slipping on pegs. Along this line mark out with a piece of solder the exact distance apart the vines or trees are to be set at.

Should vines be planted in a parallelogram instead of a square, two lines will be required, with the distances between the rows marked off on one of them and the distance along the rows on the other.

Distance Apart.

Before planting an orchard or a vineyard it is well to consider and decide what distance apart the trees or the vines will be set at. The following table shows the number of plants to the acre at the distances given below. It will be noticed that the septuple system allows 15 per cent. more trees to the acre and the quincunx 12 per cent. more than does square planting.

Distance apart in Feet.	Square Feet to each Plant.	Square.	Quincunx.	Septuple.
1	1	43,560	...	50,300
2	4	21,780		
3	9	4,840		
4	16	2,722		
5	25	1,742	1,966	2,003
6	36	1,200	1,362	1,390
7	49	889	999	1,002
8	64	680	762	782
9	81	537	600	617
10	100	435	482	500
11	121	360	399	414
12	144	302	335	347
14	196	222	250	255
16	256	170	191	195
18	324	134	151	154
20	400	109	116	125
21	441	99	110	114
22	484	90	100	103
24	576	75	83	86
25	625	69	77	80
26	676	64	71	73
27	729	60	67	69
28	784	55	61	63
29	841	50	56	56
30	900	48	53	55
35	1,225	40	44	46
40	1,600	31	34	35

A certain diversity of opinion exists regarding the best distance to plant vines and fruit trees. In this case, as in many others, extreme

views in the matter are not to be copied, and a medium course should be adopted.

If we consider *vines*, we must bear in mind that under the Australian climate, where the sum of the sun's heat is always sufficient for the complete ripening of grapes, the question of orientation is not so important as under cooler climates, and the direction to be given to the lines will be to a greater extent influenced by the shape of the field, the intensity of the hot winds if in the interior, or the sea breezes if in the coastal region. In places, also, where hail-storms sometimes occur and follow certain winds which generally come from the same quarter, the edge of the lines should be pointed towards the direction the wind blows, and not the flank, if it can be avoided.

Lines laid along the longer axis of the field rather than in the direction of its shorter width also saves a considerable amount of time and exertion on the teams, which have less turning to do.

If the vineyard is to be planted on a slope with a very marked incline, the lines and ploughings should follow the contour of the slope and be laid at right angle to its fall, so as to prevent in some measure the soil being washed down the incline during heavy downpours of rain.

Whatever disposition is given to the vineyard, the land should be exclusively planted in vines, and no other crop or trees put in.

In hot and dry districts where a thick growth of foliage would rob the ground of a considerable amount of its store of moisture, wide planting is generally resorted to, while in the cooler and moister districts, where it is desirable to promote the evaporation from the ground of as much moisture as possible, and besides encourage the growth of the roots nearer to the surface, close planting is the most profitable.

If one takes France as an example, one notices a striking difference between the Champagne district, for instance, where there are as many as 16,000 to 18,000 vines to the acre, while the number decreases the farther South one goes, being 10,000 to 12,000 in Burgundy, 4,000 to 5,000 in the Hermitage, 2,000 in the Herault, and 1,000 in Algeria.

In Australia experience has proved that the vines do better when planted further apart, and the following distances are met with:—

Square Formation.		Rectangular Formation.	
	per acre.	ft. ft.	per acre.
4 ft. apart	2,725	4 x 1	10,900
5 "	1,742	6 x 4	1,816
6 "	1,200	6 x 5	1,452
7 "	889	7 x 4	1,556
8 "	680	8 x 5	1,090
9 "	537	8 x 6	908
10 "	435	9 x 6	806
11 "	360	9 x 7	692
12 "	302	10 x 6	726
14 "	222	10 x 8	545
		10 x 12	363

The distances 12ft. by 12ft. and 11ft. by 10ft., for ordinary grapes, are certainly excessive and an unwarrantable waste of space, the cost of periodical ploughing, scarifying, outlay on purchase of land, clearing, staking and trellising, fencing being out of proportion with the number of vines. For currants and sultanas the distances might well be 10ft. x 12ft.

In the drier districts a superficial area of ground of 64 to 100 sq. ft. should be given to the vine; this is obtained by planting the vines:—

8ft. x 8ft.	giving	64	sq. ft.	each and	680	to the	acre.
9ft. x 7ft.	„	63	„	„	692	„	„
10ft. x 6ft.	„	60	„	„	726	„	„
10ft. x 10ft.	„	100	„	„	435	„	„
12ft. x 6ft.	„	72	„	„	605	„	„

The advantages of 10ft. x 6ft. over 8ft. x 8ft., are apparent for the reason that for a given area of ground more vines are planted to the acre; the distance between the rows allows drays to enter the vineyard anywhere, for carrying away grapes or the wood after pruning, while moreover, should at any time the vines be put on trellis, fewer posts, less wire, and fewer holes for the posts will be required per acre. The only disadvantage lies in the fact that those growers who work a 6ft. wide scarifier, require a narrower one when working the land crossways.

The object of reducing the number of plants per acre, as shown above, as one proceeds from the cooler districts towards the hotter or drier ones, is to equalise the development of the root system underground with the development of the aërial organs of the plant. In the South of France for instance, as well as in Algeria, where the object sought for is to promote a luxuriant growth and an abundant yield, the growth of the deeper roots must be encouraged by every means, so as to make the plant independent of droughts, and enable it to get nourishment proportionate to its yield. It is also evident that in a dry soil, where the mineral food required by the plant is not dissolved and in a state fit for assimilation, the plant requires a greater cubic space of ground than is the case in moister and richer soil.

So much for the distance apart vines may be planted. In the case of *fruit trees*, a superficial area of ground proportionate to their natural growth must be provided for.

Small trees like the navel orange, some dwarf apple trees, pear trees with an erect habit of growth, quince, etc., will require less space than the larger orange, apple, and pear trees. An orchard, however, laid out at distances varying according to the sort of fruit grown would certainly look unsightly and would moreover be difficult to cultivate; a uniform interval between the trees all through the orchard should therefore be decided on.

Many orchards are planted at distances 15ft. to 18ft. apart, but these are decidedly too close. The average fruit trees should not be planted at a lesser interval than 20ft., whereas a favourite distance would be 22ft. or three trees to the chain, which would

give 90 trees per acre if planted on the square, and 100 trees if planted in quincunx, and 103 if set in according to the septuple formation; 24ft. as well as 25ft. apart are also favourite intervals suitable for soils and localities where trees grow luxuriantly.

For the guidance of those orchardists who desire to plant certain kinds of fruit trees in blocks by themselves, the following table is given of distances found suitable for setting apart:—

Rhubarb	4 feet apart.
Gooseberries and Currants	8 ,,
Rock Melons	6 to 8 ,,
Water Melons	10 ,, 12 ,,
Table Grapes	8 ,, 10 ,,
Coffee	10 ,, 12 ,,
Guavas	12 ,, 18 ,,
Bananas and Plantains	12 ,, 18 ,,
Persimmons	18 ,, 22 ,,
Mandarines and Kumquats	18 ,, 22 ,,
Oranges and Lemons	20 ,, 30 ,,
Plums and Prunes	20 ,, 22 ,,
Peaches and Nectarines	20 ,, 22 ,,
Pears	20 ,, 25 ,,
Large Cherries	20 ,, 25 ,,
Duke's Morellos	20 ,, 25 ,,
Apricots	22 ,, 30 ,,
Apples	22 ,, 30 ,,
Figs	20 ,, 40 ,,
Walnuts and Chestnuts	30 ,, 40 ,,

If planted in rows:—Strawberries, in double rows of 1½ft. to 2ft., with 4ft. between the double rows.

Pine Apples:—In double rows 2ft. with 8ft. to 10ft. between each double row.

Raspberries:—4ft. to 8ft. between the rows.

In the June issue of this *Journal* I will deal fully with the planting of fruit trees and vines.

DISTRIBUTION OF TREES.

The Secretary to the Forestry Department desires it to be known that he is prepared to receive applications from farmers and settlers for shelter trees, such as pines, etc. Trees will be delivered free on board the train, the applicant paying railway freight. As the time for planting is now close at hand, those requiring trees should send in their applications without delay to the Secretary, Forestry Department, Pier Street, Perth.

FRUIT-GROWING IN THE EASTERN DISTRICTS.

By G. Buchanan.

The Eastern Districts, not being blessed with the abundant rainfall which occurs in the hills and along the coast line, can hardly be considered to be so favourably situated for fruit-growing as the localities where more humid conditions of climate obtain. Nevertheless, there are not wanting illustrations, in the shape of successful orchards, which show that when a suitable piece of land is chosen and proper methods of cultivation adopted, fruit of exceedingly fine quality can be produced in abundance in even this comparatively dry portion of the State.

In the vicinity of York, a good number of orchards have been planted, and among these are to be found some which are not only a credit and source of profit to their owners, but also serve to show in the plainest language what the country is capable of doing when assisted by the intelligent and energetic cultivator. The orchard of Mr. Kenneth Edwards, situated a few miles from York, is an object lesson to any who may be prepared to benefit by the experience of others. This orchard, which was commenced in a small way about 10 years ago, now covers 16 acres of ground. The soil is of good quality, belonging to the class of sandy loam overlying clay subsoil, which is to be found throughout the Eastern Districts, and, being of a friable nature, can be kept in a fine condition of tilth by the frequent use of cultivating implements.

The orchard is prettily situated on the slope of a valley, on the other side of which the residence is built on the rising ground. Apples are the crop grown principally, more than half the orchard is planted under that fruit, the remainder being mostly peaches, pears, quinces, and oranges. Mr. Edwards is a strong advocate of early fruits for his district, as he finds the ripening period much earlier than in localities nearer the coast. Among early fruits, peaches are found to do extremely well, Amsden's June and Brigg's Red May being the varieties most favoured by Mr. Edwards, though it is worth while remarking that the latter peach does not give other orchardists in these districts complete satisfaction. The varieties of peaches referred to are found to ripen about the second and third week in December, at which time top prices can be relied on, as the supply at that period is very limited. Late peaches also do well in this orchard, and Mr. Edwards points with pride to a tree of the Salway variety, which has, in three successive seasons, returned a total of £20 for the crop for that time. This tree is somewhat favourably situated

near the water supply, and probably obtains more moisture than the other trees. Mr. Edwards finds a single watering when the peaches are three-quarters grown to be most beneficial, and this is all the irrigation that is carried on with deciduous trees, though the oranges are kept supplied throughout the summer, the water being directed from a spring to the trees by means of gravitation.

The apples grown include such varieties as Gravenstein, Rome Beauty, Nickajack, Ben Davis, Dunn's Seedling, and Cleopatra; and of these kinds Mr. Edwards speaks in terms of high praise of Ben Davis, Rome Beauty, and Gravenstein, while he does not find Cleopatra—a most favoured apple in most localities—to be particularly well suited to his district. Among other fruits, apricots are found to do well, Oullin's Early Peach and Moorpark giving the most satisfactory results.

Orange and mandarin trees, assisted by irrigation, have thriven well, and their dark green leaves and well-developed fruit was a treat to see on the occasion of my visit at the end of the summer, when almost all kinds of trees were languishing for want of water consequent on the long period of dry weather. From his experience, Mr. Edwards strongly recommends Navels as the best variety to grow in dry districts, and states that this kind requires far less watering than others. The Parramatta and Siletta varieties have given good results, and, of mandarins, Queen appears to be well adapted for the locality, while grapes, of course, do well. Mr. Edwards does not find them as profitable as the other fruits enumerated, and therefore purposes replanting the ground now occupied by vines with apricots and other fruit trees.

Though the trees in this orchard have not grown to any extraordinary size, they appear to fruit with great profusion, necessitating a great amount of thinning being done. This Mr. Edwards regards as one of the most essential performances in the programme of orchard duties, and to his care and thoroughness in attending to this important work the excellence of the fruit grown in his orchard is no doubt largely attributable. At the last national show held in Perth first awards for fruit from this orchard were obtained for apples, peaches, Japanese plums, and nuts, and a third prize for pears, a record which speaks volumes for the general quality of the fruit.

The cultivation of the soil is well attended to, the ground being ploughed twice a year and kept free from weeds and in good condition by the unsparing use of the scarifier and harrows, so that as much of the moisture as possible is conserved for the use of the trees during the dry summer months. In the past very little manuring has been done, and the heavy crops and the vigorous appearance of the trees show that the fertility of the soil has been sufficient for the demands made on it. Mr. Edwards, however, intends to manure the land systematically in the future, to ensure continued crops and maintain the vitality of his trees. So satisfied is he with the returns from his orchard that he intends to add to

the area planted and to give his whole time to attending to his trees.

Another orchard in the York district well worthy of mention is that of Mr. Jas. McBean, Riverside, formerly owned by Mr. W. C. Knight, who invariably kept the place in such condition that it would be difficult to find a weed anywhere within the orchard area. The orchard is situated on the bank of the Avon, and the soil is a very fine light loam, of a like quality to that found composing the flats along the course of the Avon River. This soil should be admirably suited for the production of early fruits, as it is light, warm, well drained, and should respond quickly to the warmth of the sun. About half of the orchard is planted with apples, which do well and bear heavy crops of fruit. This season, owing to Mr. McBean being unable to attend to the thinning of the fruit at the proper time, some of the trees are simply laden with apples, with the result that much of the fruit is too small to be marketed. Peaches have thriven wonderfully well in this orchard, the soil being apparently all that is required for the growth of vigorous and prolific trees. About an acre is planted under citrus trees, but there being up to the present time no means of irrigating them, the trees suffer from a want of moisture towards the end of the summer—a rather critical time with citrus trees, as their fruit should then be well developed. At the time of my visit, Mr. McBean was carting water to those trees that were suffering from the drought, and he intends to make provision for a supply of water for these trees before next summer.

A young orchard that gives promise of being equal to any in this district is that of Mr. G. N. Morse, about seven miles from York. The trees are planted in a hollow, on an extremely rich piece of land, which is kept moist by the soakage from the higher levels around. The soil is kept cultivated to an extremely fine tilth, so that the trees get the full benefit of the moisture; and the vigorous growth of strong healthy wood, which the trees have made during the past season, shows that the attention bestowed on them is not wasted.

On the hillside near the farm buildings is to be seen an old apple tree, planted some forty years since, and this tree has provided a good deal of the stock planted in the new orchard, good varieties being budded on to suckers from the old tree. While the trees worked in this way have outstripped the other trees in the matter of growth, this is a practice that cannot generally be commended, unless the suckers to be worked are known to be Northern Spy, or some other blight-proof variety; otherwise the trees and roots may become affected by the Woolly Aphis, which is one of the most troublesome diseases to eradicate once it obtains a hold on the roots of a tree.

In the matter of diseases affecting fruit trees, the orchardist in the Eastern districts appears to have a distinct advantage over fruit-

growers in other localities, as the ordinary fruit pests do not seem to thrive so well. Of the various kinds of scale insects which are so commonly met with elsewhere, very little evidence is to be found, and diseases of a fungoid nature are not suited by the dryness of the climate. One of the only pests which seems to thrive is the Red Mite (*Bryobia Patensis*), which is to be found commonly infesting apple, pear, and other deciduous trees. Growers whose trees are affected by this pest should spray their trees thoroughly with the lime, sulphur, and salt wash, which will be found to be one of the most effective insecticides to use on trees while in their dormant condition.

Altogether, the condition of the orchards in the York district reflects great credit on those who have entered into the arena of fruit production, and anyone now planting in that locality should not fail to benefit by the experience of those engaged in the business, in regard to kinds and varieties most suited to the district, and a visit to the places I have mentioned—and of course there are others—will show the result of adopting up-to-date methods of cultivating and attending to the trees.

SUGAR FOR FEEDING BEES.

The difference between Beet and Cane Sugar.—The following article is a striking one, and adds to testimony in favour of cane sugar. It is taken from *Gleanings in Bee Culture*, and the author is W. K. Morrison, Barbadoes, formerly of Bermuda, and who is now the Lecturer on Apiculture of the Imperial Department of Agriculture for the West Indies:—"There seems to be a doubt in the minds of some that cane sugar is better than beet for feeding purposes; though European bee-masters have since arrived at the conclusion that cane saccharine matter is always superior to beet. Though the bulk of the bee-keepers who use cane sugar could not give a sound scientific reason for the faith that is in them, I do not think that their experience lacks scientific proof. In the first place, cane sugar is sweeter, just as Jersey milk is richer than Holstein milk; and for this reason alone it commands a higher price. In the London market, Demerara yellow crystals always command a higher price than any other sugar; and, knowing this, the German refiners colour their sugar with aniline dyes so as to imitate very closely cane sugar; but, like all imitations, it is not

so good as the original. Only a few days ago a grocer in England was tried for selling dyed beet sugar as 'Demarara yellow crystals,' and he was heavily fined. It was a test case, and the best legal talent was retained on either side; but the judge very properly decided that dyed German sugar was not Demarara yellow crystals, as the customer had ordered, therefore the grocer was guilty of a fraudulent transaction. According to the 'theory' of expert chemists like Prof. Wiley, cane sugar is beet sugar, and beet sugar is cane sugar; but in practice this idea is worthless. The fact is, that plain common sense is a better guide. By the same process of reasoning, 'saccharin,' which is 500 times sweeter than ordinary sugar, ought to be 'cane sugar' also, but it is not; and some countries have gone so far as to prohibit its use altogether as dangerous to the public health. Some chemists, among whom stands Prof. Wiley, maintain that honey is glucose and glucose is honey; but he is a very poor judge indeed who cannot tell the difference between the two. The chemists have been altogether too hasty in this matter, and I believe the very latest theories give the beekeepers much more standing room. What the chemists seem to forget is that honey contains small amounts of powerful substances that are not present in manufactured sugar, and, hence, to compare them is odious. Because the chemists can do nothing with these ethereal substances they have neglected them altogether, or set them down as 'extraneous substances.' I do not believe any chemist is smart enough to tell us what gives basswood or any other honey its distinctive flavour; therefore I hold that, until they can, all chemists should be careful in making round assertions with regard to honey. It is the same with sugar. The chemistry of sugar has been largely created by French and German chemists, and therefore favours beet sugar; yet we can read between the lines and see for ourselves 'whether these things are so.' The best *white* sugar sold is very highly refined, be it cane sugar or beet. The bee-men of Europe carefully avoid it because, in the process of refining, it has been robbed of some of its finest constituents. Here is an analysis of good quality of highly-refined cane sugar:—

	Per cent.
Cane sugar	98·00
Glucose	·50
Water	1·00
Ash	·30
Organic matter	·20

"Now notice the difference in a sample of muscovado sugar which has not been refined to the same extent:—

Cane sugar	84·00
Glucose	6·00
Water	5·50
Ash	1·50
Organic matter	3·00

"Notice the difference. The large amount of glucose makes it more agreeable to the bees, and the 3 per cent. of organic matter contains flavouring extracts of ethers that give to muscovado sugar

its honey-like flavour, so much appreciated by the bees. The first sugar is the best from a chemist's point of view, but from the point of view of a good Italian bee the muscovado is healthier, and nicer to the taste. I believe that, in this matter, we have been too hasty in following the crowd. American and English housewives buy sugar from its look; but the careful bee-man ought to consider that bees do not judge by looks; and in buying a sugar with a high percentage of natural glucose he is pleasing the bees and conforming to their wants. For my part, I believe the larger the percentage of glucose in sugar the better it is for the bees; and, seeing that it is cheaper than white sugar, why should we not use it? Barbadoes makes large quantities of this kind of sugar, which is exported to New York to be refined into white sugar. It is the old-fashioned sugar, but nevertheless a good one for some uses. Jaggery, or palm sugar, would be better still; but it is not easy to get, being mostly produced in India. But any sugar having a high percentage of glucose ought to have the preference, as it is more readily assimilated by being nearer their natural food, and therefore less likely to cause derangement to their intestines, ending in bee-diarrhœa and perhaps other troubles. There is no trouble in getting all the muscovado sugar that is required, hence the way is plain."

[This is one of the best, if not the very best, article on the subject on cane and beet sugar we have ever published; and, moreover, it is stated so simply that any one, be he scientist or layman, can understand every point that is made. I have till recently believed that beet sugar answered all the purposes of general cane sugar; but while on my trip through California I was told that the large canning factories on the coast positively will use nothing but *cane* sugar, because beet sugar does not give them the desired results.

Mr. Thos. Wm. Cowan, editor of the *British Bee Journal*, and, in fact, a great many of the bee-keepers in England, recommend cane sugar for feeding bees, in preference to beet, as they consider it a higher grade of sweet. But it seems to me reasonable that a beet sugar, such as we have used here at the "Home of the Honey-bee," with excellent results for 15 or 20 years, will be equally good if not better. I have always supposed that nine-tenths of the granulated sugars on the market were beet, and that the average beekeeper, in the United States at least, when he buys sugar for feeding, receives that sugar.—Ed. *Gleanings*.]

PREPARING HONEY FOR MARKET.

Fumigation for destroying all Eggs of the Bee Moth.

(E. C. Walker, in *Gleanings.*)

As soon as the honey is takén from the hive I fumigate it. I use carbon bisulphide, as sulphur is apt to discolour the comb, and if too strong leaves a disagreeable odour. For a fumigating box I use a large ice box or refrigerator, which is lined with zinc and is practically air-tight, except that it has ventilating holes at top and bottom. When supers are well filled, I place them bodily, as they come from the hive, into the bottom of the fumigating box in such a manner as to allow the free circulation of the fumes about and through them. If the supers are not entirely filled I, of course, place only the finished sections in the fumigating box. I then place an open vessel filled with bisulphide of carbon in the top part of the refrigerator and close the door. The fumes settle and circulate around the honey. It takes about an hour for the fumes to fill entirely the large fumigating box. As soon as they have I close the ventilating holes, thus stopping all draughts, and let the whole alone until morning, or for a period of from eight to ten hours.

After this time every vestige of a moth or worm or egg will have been destroyed. I then remove the vessel of carbon bisulphide and open the ventilators, and as soon as all fumes have passed off the honey is ready to be removed.

The honey is then stored in a warm room on shelves and allowed to sweat. The room should have screen doors and windows, and should be opened to allow a free circulation of air.

Next the sections are scraped, all propolis and stains being removed. As the sections are cleaned the honey is graded. I use three grades. Then it is put in twenty-four pound single-tier, non-drip shipping cases, with glass on one side. It doesn't pay to face the crates. Put sections next to the glass that are a fair sample of the rest of the honey in the whole crate.

After the honey is crated I put a label on each case, stating grade, net weight, gross weight, and number of sections in case.

Being near my market, I take a sample section of each grade and call on my customers or any dealers to whom I wish to sell. I show my goods and ask them if they wish to purchase. If they are not handling honey, and are in doubt as to whether they want to do so, I propose that they let me bring them a case on trial, and in nine cases out of ten when I see them again they want more. I sell for cash.

STOCK AND STATION.

NEWS AND NOTES.

By Norman Malcolm, Inspector of Stock.

Introductory.

It is my intention to supply readers of *The Journal* with a brief synopsis of the various reports of diseases and local disorders received by the Stock Department each month, and the advice tendered by the Government Veterinary Surgeon (Mr. R. E. Weir, M.R.C.V.S.,) in every instance, together with any other information obtainable which should be of general interest to stock-owners and breeders. With the object of attaching the greatest accuracy and value possible to the matter supplied through these columns, I must, however, ask in the first place for the assistance of those engaged in the livestock industry, as, upon the information forwarded by them to the Stock Department relative to the appearance of disease among their flocks and herds depends, in many instances, the correct diagnosis of the trouble and the successful application of preventive or remedial measures. For instance, it is not sufficient for a settler to report, "My cow is dead, please tell me the cause," or "Some of my sheep have gone blind; could you give me any remedy to treat them with," as in many instances these occurrences take place in outlying districts and cannot be attended to by the veterinary surgeon, consequently replies to such communications must be in a large measure speculative, and their value is minimised. Very often the information supplied to the Department is too meagre to hazard any advice, and much valuable time is lost in correspondence before treatment can be prescribed. In connection with an outbreak of disease, promptness in reporting the matter to the Department is the first consideration, and if stock-owners would give increased attention in this direction their losses would be decreased. By omitting to report diseases, they also overlook the fact that they are rendering themselves liable to

Heavy penalties

under "The Stock Diseases Act, 1895," which provides that "Every owner of infected stock or of stock suspected to be infected shall, within twenty-four hours of the time when he shall have discovered or suspected such stock to be infected, give written notice thereof to the nearest inspector, and shall thenceforth keep such infected or suspected stock from coming into contact with other stock until otherwise ordered by an inspector." In making these reports I would like to call the attention of stock-owners to the importance of not only advising the Department that some disease has appeared,

but of supplying particulars relative to the symptoms displayed by the animals infected, and, in the event of death, the *post mortem* appearances.

List of Inspectors.

For the assistance of stock-owners I publish hereunder a list of inspectors, with their addresses, to whom reports may be forwarded in accordance with the Act:—

Chief Inspector of Stock	Perth
Norman Malcolm	Perth
R. E. Weir (Veterinary Surgeon) ...	Fremantle
S. Stephens	Fremantle
H. H. Ranford	Wyndham
M. S. Warton	Broome
C. D. V. Foss	Carnarvon
A. T. Stanbridge	Roebourne
Raymond Eliot...	Geraldton
W. B. Mitchell	Bunbury
E. Pickett	Hamelin
W. G. Knight	Albany
E. J. McCarthy	Esperance
C. D. McLauchlan	Eucla
H. Nathan	Coolgardie

Impaction of the Rumen.

Recently a report was received from Katanning relative to the loss of three valuable milking cows within a period of six weeks. The correspondent stated:—"Two of them died in rapid succession, and I think it must be some disease, as the last one that died had been eating the bran which the other one left, and took ill the same day. They were in fair condition, one being heavy in calf. They were sick only three days; would feed very little, and would lie down most of the time; did not appear to have much pain until about an hour before death. The most peculiar thing I noticed about them was that they slobbered very much from the mouth, and the three of them had their tongues hanging out. The tongues were swollen, and it seemed as if the cows could not get them back into their mouths."

The matter having been referred to Mr. Weir, he reported as follows:—"The symptoms described point to the digestive organs having been the seat of the disease, and the trouble may have arisen from impaction of the large paunch or rumen. Treatment—In the early stage give a dose of purgative medicine: Epsom salts, 1½lbs., common salt, ½lb., ginger, 2oz., treacle, ½lb. To prepare, mix the salts in hot water, then add the other ingredients, and give as a drench. On the following day, give stimulants such as whisky (two wine-glasses full) every four hours in the form of a toddy. Should pain be present, give laudanum, 2oz., calomel, 1 dram, every four hours. Give a plentiful supply of cold water to drink, and food to consist of scalded bran and chaff."

Round Worms.

A correspondent, writing recently from Moojebing, and forwarding the stomach of a foal for inspection, stated:—"The parcel contains also a few of the worms which I discovered when opening the foal. About one gallon of these worms were found in the small entrails, as if leaving the paunch. I dosed this foal in the morning and in the evening. It seemed to be suffering from terrible pain, and died the following morning. It seemed to be breathing very heavily when in pain. The drench administered consisted of the liquor taken from boiled barley, well sweetened with sugar, a pint and a half of the liquor being mixed with 1oz. of Epsom salts.

Mr. Weir, V.S., reported that the stomach contained a large number of "Round Worms," and showed abrasions on the inner wall of the organ, caused by those parasites. Continuing, he said, "Round Worms are frequently found on making *post mortem* of horses, and they cause little inconvenience excepting when present in large numbers, as in the present instance. By rolling over one another they form large balls within the intestines, producing colic, inflammation of the bowels, and death. Treatment:—Give every morning, in a small mash, for 12 days, one teaspoonful of equal parts of iron and copper sulphate. When pain is present give an aperient—Aloes (Barbadoes), 2 drams to a foal (4 to 8 to a horse), combined with laudanum 2 drams to 1 ounce (or linseed oil, raw, 1 pint and oil of turpentine 1 ounce). Preventive—Rock salt should be kept in the mangers, and the animals fed liberally. Two feeds daily should be sufficient for horses out of work, but evidently the horses in this instance have not been kept in good condition with that amount."

Horse Breeding for Remount Purposes.

An interesting and instructive report by the "Horse and Mule Breeding Commission," appointed by the Government of India, has just come to hand, in which reference is made to the Australian horse supply. The report states:—"While at Calcutta the Commission met the Australian shippers and heard their views on the horse supply, and subsequently the following letter, signed by all the principal shippers, was received:—'We have the honour to place before you our views regarding the horse breeding of Australia. In our opinion it is deteriorating, due to the cause of inferior stallions, and exporting most of the best mares; breeders being tempted to sell on account of the high prices being given for Indian remounts. We think it would be beneficial to the industry if you were to advise the Australian Governments to put a heavy tax on stallions, and limit the exportation of mares suitable for breeding. Also the Government should supply a number of stallions for the use of breeders at a nominal fee for service.'"

The report, continuing, states:—"The supply is decreasing and deteriorating by the lavish export of the best mares, the

inferior ones only being left for breeding; by the increasing demands of other countries, demands that are likely to increase rather than diminish; and because inferior stallions are used Thus, if the present standard of remount is to be maintained, it is certain the price must be raised. And in the opinion of those members of the Commission who have watched the horse supply for some years, not only has deterioration set in, but it is bound to increase rapidly; the shippers assert that India has many of the best mares now, and the number of mares purchased does not decrease."

With regard to the suggested establishment of depôts in Australia by the Imperial Government, the Commission considered the following objections were sufficient to deter the adoption of the scheme:—"(*a.*) That the experiment has been tried and proved a failure. (*b.*) That an exceptionally skilful and experienced staff of buyers must always be maintained, and any want of tact or judgment on their part might result in the formation of an adverse ring among breeders. (*c.*) That a heavy outlay in purchase of land and erection of a depôt would be necessary. It is understood that good land, conveniently placed, could not be acquired for less than £10 an acre, and the risk of disease breaking out would be considerable unless there was a large range of paddocks. (*d.*) That it is very difficult to select 'eye sound' horses of suitable type from a mob of unhandled animals, and a number of 'misfits' would be the inevitable result. These a dealer could get rid of without much loss; but a Government buyer in a similar position would be certain to lose heavily. (*e.*) That there would be complaints of interference with a trade. (*f.*) That the establishment of such a concern would absorb money, energy, and attention which would be better employed in fostering horse-breeding in India."

The Stock Imported during 1901.

During the year the imported stock landed at the various ports of the State were as follows:—

	Horses.	Cattle.	Sheep.	Pigs.	Dairy Cows.	Bulls.	Ewes.	Rams.	Dogs.
Fremantle ...	1072	6759	53628	1419	256	79	251	1312	132
Albany	156	221	2656	4	10	1	34	98	14
Eucla	120	123	7751	2	18	3	...	...	8
Geraldton ...	1	...	95	...	...	...	...	...	2
Esperance ...	...	...	...	...	...	...	...	9	...
Wyndham (overlanded from Northern Territory)	247	6408	...	...	...	...	...	...	...
Totals ...	1596	13511	64130	1425	284	83	285	1419	156

In addition to these stock 20 donkeys, 4 goats, and 3 camels were also imported.

For purposes of comparison, I will give the imports of stock for slaughter for the past five years, which are as follows:—

Year.	Cattle.	Sheep.	Pigs.
1897	13225	118544	8587
1898	15410	79802	8615
1899	7921	88338	4322
1900	13105	81423	4359
1901	13511	64130	1425

The figures here supplied, as regards sheep and pigs, are an interesting study, as it will be seen that despite a greatly increased population local supply is fast overhauling demand. Last year we had to import only a little more than half the number of sheep required in 1897, while the local pig-raising industry has accounted for an even greater reduction in consignments of this class of stock during the same period.

The number of cattle shipped to Fremantle from the Kimberley districts during the year were as follows:—

East Kimberley	7,619
West Kimberley	5,061
Total	12,680

IMPORTATION OF FRUIT TREES.

Complaints having reached the Department from persons who had purchased imported trees that they were not true to name, it would not be out of place at this time to reprint a notice of an action taken by the late Secretary of the Bureau of Agriculture some few years back, dealing with this matter. It will also act as a warning to those who are about to plant:—"The action of the Bureau of Agriculture against John Henry MacGill, though it was dismissed on technical grounds, shows how careful people ought to be in purchasing fruit trees, and how great a scope there is for deception and fraud. The offence alleged against MacGill is, the Bureau has every reason to believe, not singular to that astute individual. Briefly it is this: A number of trees, say, of the citrus tribe, are imported. They arrive at Fremantle in bundles of, say, 100 or more, and are put through the disinfecting process. The trees are

unpacked and individually handled by the Inspector, who notices that they bear no labels of any kind to distinguish the variety. When the trees are being repacked, however, the trees then become definite varieties. They are taken up haphazard, half a dozen at a time, with one hand, and with the other the 'faker'—a common but expressive term—draws a ready prepared label from his pocket, which he attaches to the trees. These labels do not all bear the same name. If they did there would be nothing more to say. They bear the names of different varieties, and as they also are taken haphazard from the pocket, it necessarily follows that it is a mere matter of luck what variety the first half-dozen or the second half-dozen of trees become. If the first label to be drawn out bears the words Washington Navel, the first half-dozen trees picked up become 'Washington Navels' as soon as the label is attached. The trees were, in this case, subsequently sold at auction, and according to the laws which govern auctions, the purchaser buys with all faults. So that if the trees are not true to name the 'fault' lies with the person who is stupid enough to buy and not with the one who has done the faking. Consequently the purchaser has no redress. Though the case was dismissed on technical grounds, the object of the Bureau has nevertheless been attained, and it is to be hoped the case will serve as a warning in the future to intending planters to buy their trees from reliable nurserymen, and then only on a guarantee as to their being true to name. No really reliable nurseryman will object to give a reasonable guarantee, and one who does, should be left severely alone. It is known that various swindles have been perpetrated this season upon unsuspecting purchasers of imported trees. Seedlings by the hundred have been palmed off as worked trees. It is very simple. The seed is sown in the nursery. Two shoots grow, and one is cut off close and the other is allowed to grow. The place where the shoot was cut off leaves a mark, giving the uninitiated the impression that the tree has been grafted or budded. The importations of trees have been very heavy this season, showing that the fruit industry is moving along, and it is absolutely necessary, if the industry is to prosper, that a good start should be made. It is needless to say that planting out trees bought at auctions because they are cheap and mutilated seedlings is not the best way to start an orchard, and the sooner growers profit by the lesson contained in the MacGill case the better it will be for all concerned."

SOME DEDUCTIONS FROM THE MODEL DAIRY TEST.

A PRACTICAL CONSIDERATION OF VARIOUS FEATURES.

(From the *Jersey Bulletin.*)

Elsewhere in this issue will be found the report of the results of the Model Dairy test, conducted at the Pan-American Exposition, Buffalo, N.Y., May 1 to November 1, 1901, with comments by our efficient correspondent, "The *J. B.* Man on the Spot." There will be found the total yield of milk, estimated butter and value thereof, cost of feed and net profit for 26 weeks, of each of the fifty cows participating, as well as the totals for each lot of five cows in the ten breeds. There is also an aggregate report of each breed's work in the test for churned butter, for solids, and for solids combined with gain in weight.

These figures tell their own story, and readers can gather much from them, each according to his own idea. Our correspondent has done so, and everyone so inclined is at liberty to express himself through the *Jersey Bulletin* on any feature he deems worthy of comment. There are a number of points, not apparent at a glance at the tables, that are of great interest to dairymen, some of which the *Jersey Bulletin* will point out in this article. But before doing so, we wish to caution our readers not to find fault if some of the figures given herewith are inconsistent with those in reports given out in various places as "official."

These discrepancies amount to very little; this is shown by the fact that the *Jersey Bulletin's* total for net profit in each breed for the entire period in no case varies over 51 cents from that given out by the Pan-American Press Department, while in several cases it is within a few cents. Of course our representative secured his figures from the same source as the Press Department did, and it would appear that there should be no difference between them—but there is. The recapitulation in our Buffalo letter is made from the reports as published each week in the *Jersey Bulletin*, and all deductions herewith are from the same source, except those relating to the churned butter, solids alone, and solids-with-weight test. The latter came from the Pan-American Press Department, through the courtesy of Mr. F. A. Taber.

This department has issued a report of the butter fat test which gives the yield of pure fat instead of estimated butter; in our correspondent's report the estimated butter is given, so that there will be considerable difference in these columns. But as the award was made on estimated butter at 25 cents a pound, we deem it proper to report it in that way.

Some of the Features.

The first thing to strike the reader is the awards; the five Guernseys made $4·93 more net profit in the fat test and $5·86 more in the churn test than did the Jerseys, which stood second in each test; and the Holsteins made $26·44 more in solids and $31·63 more in solids and weight than the Ayrshires, which stood second in those tests. But these facts are of little account; it was not a comparison of breeds and was not so intended, although Superintendent Converse refers to it as such in his statement. Some of our good friends are already "making capital" of the results, but that was to be expected. The test serves its purpose, however, in furnishing some statistics that will prove interesting, if not altogether valuable as instruction, in line with the teachings of dairy schools and experiment stations. It took on a dual purpose aspect when an award was made for gain in live weight, but even that will engage many of our readers.

Variation in Fat Test.

One of the most interesting studies is the variation in average of fat tests week by week of the different herds. We have devoted much time and labour to compiling the accompanying table and showing this variation. The average of weekly fat tests is struck by adding the tests of all cows together and dividing the sum by 5; while the average of tests for whole period is made by adding the week's tests and dividing the sum by 26. It will be noticed that the French Canadians showed the greatest variation during the test, being lowest in the second week with 3·56 per cent., and highest in the twenty-third with 4·76—a range of 1·2 per cent. The Dutch Belted showed the least: 3·66 in the last week and 3·08 in the third—a range of but ·58 of 1 per cent.

All breeds made their highest weekly average test during the last four weeks, and their lowest average during the first four. The general tendency was upward as the test progressed, although there was a constant "teetering." The greatest variation from one week to the next was with the Polled Jerseys in the tenth week, when they gained ·73 of 1 per cent. over the ninth, the average for the five cows going from 4·6 to 5·33; but the next week they went back again to 4·66 per cent.

During the extremes in these tests the week's milk yield was above the average when the test was lowest, in every herd but the Dutch Belted; while the cows gave less milk than the average during the week of highest test, except with the Holsteins and Dutch Belted. For instance, the five Jerseys had a weekly average yield of milk of 1,038lbs., and an average of fat tests for the entire period of 4·82; their highest weekly fat test was in the twenty-fifth week (5·39), when they gave 820lbs. milk; lowest, in third week (4·16), when they gave 1,336lbs. milk. This feature was the same in all breeds except the Holsteins and Dutch Belted, which proved exceptions to the "rule." The Holstein average milk yield was 1,505lbs. per week for five cows; average weekly test 3·31; highest

test. 3·61, in last week, and 1,643lbs. milk; lowest test, 2·94, third week, 1,790lbs. milk. Dutch Belted average 957lbs. milk, 3·38 per cent. fat; highest test, 3·66, last week, 1,051lbs. milk; lowest test, 3·08, third week, 853lbs. milk.

WEEKLY AVERAGE OF BABCOCK TESTS OF EACH HERD IN THE MODEL DAIRY, FOR ENTIRE PERIOD OF 26 WEEKS.

	Jerseys.	Polled Jerseys.	Guernseys.	Red Polls.	French Canadians.	Ayrshires.	Brown Swiss.	Shorthorns.	Dutch Belted.	Holsteins.
First week	4·65	4·45	4·60	4·30	3·70	3·50	3·45	3·50	3·15	3·25
Second week	4·22	4·47	4·64	3·68	3·56	3·35	3·48	3·38	3·09	3·00
Third week	4·16	4·30	4·32	3·74	3·64	3·30	3·46	3·02	3·08	2·94
Fourth week...	4·21	4·40	4·11	3·99	3·61	3·52	3·56	3·23	3·23	3·01
Fifth week	4·16	4·31	4·19	3·88	3·70	3·35	3·48	3·15	3·18	3·36
Sixth week	4·30	4·48	4·13	3·81	3·70	3·46	3·47	3·25	3·21	3·37
Seventh week	4·59	4·37	4·31	3·89	3·88	3·63	3·54	3·77	3·32	3·11
Eighth week	4·30	4·41	4·34	3·86	3·72	3·71	3·47	3·28	3·26	3·21
Ninth week	4·63	4·60	4·50	3·96	3·94	3·76	3·62	3·50	3·29	3·27
Tenth week	4·45	5·33	4·47	3·87	3·78	3·63	3·56	3·52	3·35	3·14
Eleventh week	4·56	4·66	4·48	3·82	3·58	3·67	3·52	3·57	3·21	3·22
Twelfth week	4·59	4·63	4·50	3·91	4·03	3·86	3·58	3·80	3·20	3·44
Thirteenth week ...	4·36	4·46	4·44	3·79	3·87	3·71	3·54	3·49	3·36	3·16
Fourteenth week	4·74	4·88	4·74	3·90	4·08	3·72	3·58	3·60	3·48	3·24
Fifteenth week	4·85	4·74	4·69	3·93	4·05	3·80	3·64	3·70	3·43	3·44
Sixteenth week	4·45	4·68	4·77	3·98	4·01	3·90	3·74	3·62	3·41	3·27
Seventeenth week	4·75	4·84	4·84	4·15	4·16	3·76	3·66	3·76	3·46	3·32
Eighteenth week	4·67	4·67	4·82	3·90	4·09	3·64	3·59	3·56	3·49	3·30
Nineteenth week	4·67	4·79	4·71	4·14	3·98	3·80	3·69	3·69	3·50	3·30
Twentieth week	4·80	4·84	4·95	4·11	4·28	3·77	3·81	3·72	3·56	3·37
Twenty-first week	5·10	5·02	5·04	4·30	4·51	3·91	3·83	4·01	3·60	3·42
Twenty-second week ...	5·10	5·07	5·23	4·36	4·37	3·96	3·98	4·06	3·61	3·60
Twenty-third week ...	5·18	5·22	5·18	4·47	4·76	3·86	4·08	4·17	3·54	3·57
Twenty-fourth week ...	5·31	5·24	5·12	4·39	4·75	4·03	4·21	4·08	3·54	3·55
Twenty-fifth week	5·39	5·19	5·27	4·44	4·55	4·11	4·13	4·08	3·57	3·49
Twenty-sixth week ...	5·30	5·40	5·20	4·53	4·65	4·03	4·16	4·22	3·66	3·61
Average of the tests for entire period	4·82	4·75	4·68	4·04	4·04	3·72	3·69	3·64	3·38	3·31
Highest average for any one week	5·39	5·40	5·27	4·53	4·76	4·11	4·21	4·22	3·66	3·61
Lowest average	4·16	4·30	4·11	3·68	3·56	3·30	3·45	3·02	3·08	2·94
Extent of variation ...	1·13	1·10	1·16	·85	1·20	·81	·76	1·20	·58	·67

"COMPARING ESTIMATES."

From the manner in which the award on churned butter was made, the butter was just as much an estimate as in the fat test. Only one day's milk was churned each week and the records apportioned each cow per yield of milk. The standing of the breeds in this award is the same as in the fat test, except that the French Canadians and Brown Swiss are transposed; but the net profit differs considerably in the two tests. The greatest difference is of $18·19 in the Holstein figures: in the fat test their net profit is $211·07, while in the churn test it is $192·88. These records were both made from the same milk, and on the same feed, at the same time, and by the same cows; what is the reason for the discrepancy? By the churn test every breed fell off in net profit from that in the fat test, to the extent of from four to eighteen dollars, with the exception of the French Canadians, which gained $5 47. The

Guernseys lost $10·05; Jerseys, $10·98; Ayrshires, $4·87; Holsteins, $18·19; Red Polls, $5·91; Brown Swiss, $6·20; Shorthorns, $8·00; Polled Jerseys, $9·00; and Dutch Belted, $4·90.

What is the reason for this? Is it possible the element of churnability cuts all this figure, notwithstanding the limited extent to which it entered the proposition? Or can it be that it is impossible to take two systems of estimating butter yield and make them agree?

The largest yield of milk by any one cow was 8,140·71bs. by a Holstein. The largest yield of estimated butter by any one cow was 354·26lbs., by a Guernsey. The average weekly milk yield of each cow in each breed is as follows:—

1.	Holsteins	301·76lbs.
2.	Ayrshires	253·81lbs.
3.	Shorthorns	244·42lbs.
4.	Brown Swiss	237·70lbs.
5.	Red Polls	220·07lbs.
6.	Guernseys	208·67lbs.
7.	Jerseys	207·59lbs.
8.	Dutch Belted	191·48lbs.
9.	French Canadians	189·66lbs.
10.	Polled Jerseys	156·76lbs.

Report of Six Months' Work of all Cows in the Model Dairy, Pan-American Exposition.

(By "the *J. B.* Man on the Spot".)

Buffalo, 3rd November, 1901.

I hereby announce the awards in the breed test in the Model Dairy as follows:—

The prize for net profit in butter fat is won by the Guernseys by a net profit of $4·66.

The prize for net profit in churned butter is won by the Guernseys by a net profit of $5·86.

The prize for net profit in total solids is won by the Holsteins by a net profit of $26·44.

The prize for net profit in total solids and gain in live weight is won by the Holsteins by a net profit of $31·63.

F. A. Converse.

The Model Dairy is closed, the test is ended, the cows have been taken home, and the whole event, both educational and otherwise, has passed into history.

Like the Pan-American Exposition, it has in every way (except the financial one) been a great success, and even the deficit of $4,020·11 might have been wiped out and a margin of profit shown instead had the officials provided space to retail the milk at the Model Dairy from the beginning, instead of selling it wholesale, and even giving it away until the latter part of July, when the idea assumed proper shape and the milk booth was installed. Up to that time (15th August) the sales of milk and butter amounted to but $2,632·63, during the period when all the cows were in their best condition. For the month of August the sales amounted to $2,235·57, and from 1st August to 31st October the sales were three-fourths of the whole amount.

I only give these details that those who may be interested in similar events in the future may profit by the experience of the Pan-American officials.

As Mr. Van Alstyne told me a few days ago, "the Jersey breeders have no reason to feel disappointed at the outcome of the test, considering the condition in which the Guernseys and Jerseys entered and the manner in which the test finally closed.

The Guernseys entered the Model Dairy test under the most favourable conditions, three of the five cows calving in April, on the Pan-American grounds. All were in the pink of condition on 1st May, and all carefully prepared to do their best.

On the other hand, we found the Jerseys *selected* by the Canadian Live Stock Commission *but three weeks before the test opened*. They had no preparation whatever; but one of the five had ever been fed to her capacity; two had been milking since 1st March, one of them being in calf when the test opened; another due to calve during the second week of the test.

Who is it that would wager on the outcome of a test by such contestants? Yet, at the close of the test, we find the lead of the Guernseys less than it was at the close of the third week; and we find further that, taking the relative position of each individual into consideration, the Jerseys stand higher than any other breed, for while we find the Guernsey cows standing first, third, fifth, eighteenth, and forty-third (a total of 70), we find the Jerseys holding fourth, seventh, eleventh, twelfth, and twenty-ninth positions (total 63) and the best all-round herd in the test.

A glance at the "recapitulation" will show that but for the extraordinary work done by Mary Marshall, the Guernseys would not have finished nearly so well as they did.

The showing made by Queen May of Greenwood, who carried calf during the entire six months of the test (finishing seventh, with a profit of $47·46), I consider the best, for she will have had calf and again be fresh before the others will have had their calves, which will be an item worth considering, as a number of cows that will not be bred until they arrive at home will be laid up dry for some time. Nubbinridge Queen obtained the highest percentage mark, testing 7·2 per cent. in the last week of the test.

Standing in the Fat Test.

The breeds finished according to net profit in the fat test as follows:—

	Butter Value.	Cost.	Profit.
1. Guernseys	$367·21	$136·79	$230·42
2. Jerseys	363·23	137·74	225·49
3. Ayrshires	358·62	140·84	217·78
4. Holsteins	375·21	164·14	211·07
5. Red Polls	335·76	138·02	197·74
6. Brown Swiss	330·34	147·31	183·03
7. French Canadians	289·43	113·09	176·34
8. Shorthorns	334·86	162·09	172·77
9. Polled Jerseys	279·00	109·41	169·59
10. Dutch Belted	249·22	132·36	116·86

But when we wish to pick out the breed that will return the greatest amount for the investment in feed, we find that butter produced by either the following breeds would cost:

1. Guernseys	$9·31 per 100lbs.
2. Jerseys	9·48 per 100lbs.
3. French Canadians	9·76 per 100lbs.
4. Polled Jerseys	9·80 per 100lbs.
5. Ayrshires	9·81 per 100lbs.
6. Red Polls	10·27 per 100lbs.
7. Holsteins	10·93 per 100lbs.
8. Brown Swiss	11·14 per 100lbs.
9. Shorthorns	12·10 per 100lbs.
10. Dutch Belted	13·27 per 100lbs.

All of which but endorses the findings at the World's Fair at Chicago in 1893. Now, as then, the Channel Island cattle lead, because it is quality not quantity which counts in a butter or fat test; and the Model Dairy test has shown that the Jersey cow has nothing to fear in either contest.

Again, if we refer to the foregoing list of the standing of the breeds, we may note that *six Jerseys* can be fed for the same amount which it would cost to feed either *five* Holsteins or *five* Shorthorns. If, therefore, a test were inaugurated to allow each breed a certain amount of feed at equal value, it would be found that such breeds as the Holsteins, Shorthorns, etc., could not come within speaking distance of the Jerseys in the amount of returns for the investment.

If Jerseys of the quality of those in the Canadian contribution to the Model Dairy can make such a creditable showing, what then would be the result were we to enter such cows as are known to be, by practical experiment, the best that can be bred? The *J.B.* man is gratified at the showing made by the Model Dairy Jerseys, as he is satisfied that, with proper preparation, they are, with one exception, hard to beat.

I think a reference to the pictures of these cows printed in the *Jersey Bulletin* last August, after being in close confinement during some awfully hot weather for nearly four months, will bear me out in this matter. When breeders have come to me with complaints or criticisms of the Jerseys, I have always requested them not to be hasty, as I thought they would come out all right, considering conditions, etc., and I believe they have.

STANDING OF EACH COW, ACCORDING TO HER NET PROFIT IN FAT TEST.

1.	Mary Marshall	Guernsey	$59·41
2.	Mayflower 2nd	Red Poll	52·10
3.	Cassiopeia	Guernsey	50·42
4.	Primrose Park's Prude	Jersey	50·24
5.	Procris of Paxtanng	Guernsey	49·49
6.	Beauty of Norval	Holstein	49·43
7.	Queen May of G.	Jersey	47·46
8.	Betsey 1st of F.M.	Ayrshire	46·06
9.	Pearl of Woodside	Ayrshire	45·45
10.	Kirsty Wallace of A.	Ayrshire	45·33
11.	Gipsey of Spruce Grove	Jersey	44·78
12.	Mossy of Hursley	Jersey	44·49
13.	Hulda Wayne's Aagie	Holstein	44·11
14.	Susie	Red Poll	43·79
15.	Miss Molly	Shorthorn	43·01
16.	Nubbinridge Queen	Polled Jersey	42·89
17.	Alice 2nd of Lessnessock	Ayrshire	42·24
18.	Vega	Guernsey	41·74
19.	Belle T.	Brown Swiss	41·23
20.	Tidy Abbekirk	Holstein	41·12
21.	Denise Championne	French Can.	40·63
22.	Rouen	French Can.	40·62
23.	Eliza 2nd	Brown Swiss	40·59
24.	Inka Mercedes De Kol	Holstein	39·71
25.	Liena Flory	French Can.	39·41
26.	Ora	Polled Jersey	39·17
27.	Pride's Favorite	Polled Jersey	38·95
28.	Lady Flora of O.	Ayrshire	38·70
29.	Maple Avenue Rexina	Jersey	38·52
30.	Easter	Red Poll	38·16
31.	Belle of Warwick	Dutch Belted	38·02
32.	Hope of Minnesota	Brown Swiss	37·35
33.	Meg	Holstein	36·70
34.	Queen Bess	Shorthorn	36·31
35.	14th Princess of Thula	Shorthorn	33·70
36.	Lucy B.	Brown Swiss	33·52
37.	Phyllis	Polled Jersey	33·19
38.	Luna	French Can.	32·74
39.	Flora 2nd	Red Poll	32·10
40.	Tryste	Red Poll	31·59
41.	Rose 3rd	Shorthorn	30·95

STANDING OF EACH COW, ACCORDING TO HER NET PROFIT IN FAT TEST—*continued.*

42.	Nikola	Brown Swiss	30·34
43.	Madora Fern	Guernsey	29·36
44.	Daisy D.	Shorthorn	28·80
45.	Madeline	Dutch Belted	27·14
46.	Holland Creamery	Dutch Belted	25·16
47.	La Bouchette	French Can.	22·94
48.	Justina	Polled Jersey	15·39
49.	Merletta	Dutch Belted	15·05
50.	Alberta	Dutch Belted	11·49

STANDING OF THE BREEDS IN TEST FOR NET PROFIT ON TOTAL SOLIDS.

	Total Solids.	Value of Solids.	Cost of Feed.	Profit.
	lbs.			
1. Holsteins	4,742·57	$326·83	$164·69	$262·14
2. Ayrshires	4,185·39	376·68	140·98	235·70
3. Brown Swiss	3,943·92	354·95	147·26	207·69
4. Guernseys	3,774·93	339·74	136·99	202·75
5. Red Polls	3,773 73	339·64	138·03	201·61
6. Jerseys	3,769·98	339·30	137·78	201·52
7. Shorthorns	4,086·58	367·79	162·12	205·67
8. French Canadians ...	3,287·36	295·86	113·10	182·76
9. Polled Jerseys	2,831·67	254·85	109·47	145·38
10. Dutch Belted	3,066·47	275·98	132·32	143·66

The yield of churned butter is computed from the actual results of one day's churning of each breed's cream from the milk of one day each week, and the yield for the week determined from the churning in proportion to the total milk yield of the breed for the week.

Owing to lack of machinery during the first three weeks, no churnings were made. The amount of the butter credited for this period was determined in a similar manner from the actual churnings during the following three weeks.

PRODUCTION OF CHURNED BUTTER.

Breed.	Churned Butter.	Value Butter.	Cost of Feed.	Net Profit.
	lbs.			
Guernsey	1,429·43	$357 36	$136·99	$220·37
Jersey	1,409·15	352·29	137·78	214·51
Ayrshire	1,415·87	353·89	140·98	212·91
Holstein	1,439·28	357·57	164·69	192·88
Red Polls	1,319·45	329·86	138·03	191·83
French Canadians	1,179·65	294·91	113·10	181·81
Brown Swiss	1,296·36	324·09	147·26	176·83
Shorthorns	1,307·55	326·89	163·12	164·77
Polled Jerseys	1,080·35	379·06	100·47	160·59
Dutch Belted	977·10	244·28	132·32	111·96

Production of Milk Solids and Live Weights.

Breed.	Total Solids.	Value Total Solids.	Gain Live Weight.	Value Live Weight.	Total Credit.	Cost of Feed.	Net Profit.
	lbs.		lbs.				
Holsteins ...	4,742·57	$426·83	391	$11·73	$438·56	$164·69	$273·87
Ayrshires ...	4,185·39	376·68	218	6·54	383·22	140·98	242·24
Shorthorns ...	4,986·58	367·79	802	24·06	391·85	162·12	229·73
Brown Swiss ...	3,843·98	354·95	198	5·94	360·89	157·26	213·63
Red Polls ...	3,773·73	339·64	349	10·47	350 00	138·03	212·08
Guernseys ...	3,774·93	339·74	195	5·85	345·59	13[illegible]·99	208·60
Jerseys	3,769·98	339·30	189	5·67	344·97	137·78	207·19
Fr'nch Canadians	3,287·36	295·86	288	8·64	394·50	113·10	191·40
Dutch Belted ...	3,065·47	275·98	376	11·28	287·26	132·32	154·94
Polled Jerseys ...	2,881·67	254·85	275	8·25	263·10	109·47	153·63

Aggregate Yields of Cows in Model Dairy.

Recapitulation, 1st May to 31st October, 1901.

Official Record of the Work of each Cow for Six Months.

Names of Breeds and Individuals in each Breed.	Milk.	Butter 85% fat (estimated).	Butter Value.	Cost of Feed.	Profit.	Cost of Butter per pound.
	lbs.	lbs.				Cents.
Jerseys.						
Gipsy of Spruce Grove 60241 ...	5,79[illegible]·30	3[illegible]·21	$ 75·05	$ 30·27	$ 44·78	
Primrose Park's Prude 80475 ...	4,639·30	308·24	77·05	26·81	50·24	
Queen May of Greenwood 112458 ...	5,343·10	298·54	74·63	27·17	47·46	9·48
Maple Avenue's Rexina 10922[illegible] ...	5,451·9[illegible]	256·01	64·00	25·48	38·52	
Mossy of Hursley 116745	5,762·40	290·01	72·50	28·01	44·49	
Total	26,937·00	1,453·01	363·23	137·74	225·49	
Polled Jerseys.						
Phyllis	4,430·00	228·12	57·02	23·83	33·19	
Pride's Favorite	4,569·10	247·71	61·92	22·97	38·95	
Nubbinridge Queen	4,010·00	165·98	66·49	23·60	42·89	9·80
Justina	2,565·00	124·95	31·23	15·84	15·39	
Ora	4,8[illegible]4·80	249 36	62·34	23·17	39·17	
Total	20,378·90	1,116·12	279·00	109·41	169·59	
Red Polls.						
Tryste 5167	5,422·20	234·97	58·74	27·15	31·59	
Easter 10202	6,058·70	263·96	65·99	27·83	38·16	
Mayflower 2nd 8025	6,161·50	323·15	80·79	28·69	52·10	10·27
Susie 9011	6,430·10	287·50	71·86	28·07	43·79	
Florie No. 2 8528	4,628·40	233·55	58·38	26·28	3[illegible]·10	
Total	28,700·90	1,343·13	335·76	138·02	197·74	
Shorthorns.						
14th Princess of Thula	5,885·70	264·79	66·19	32·49	33·70	
Daisy D.	6,054·40	244·74	61·18	32·38	28·80	
Miss Molly 24556	6,894·10	301·47	75·37	32·36	43·01	12·10
Queen Bess 21786	6,547·90	275·21	68·80	32·49	36·31	
Rose 3rd 113205	6,492·80	253·35	63·32	32·37	30·95	
Total	31,874·90	1,339·56	334·86	162·09	172 77	

Aggregate Yields of Cows in Model Dairy—*continued.*

Names of Breeds and Individuals in each Breed.	Milk.	Butter 85% fat (estimated).	Butter Value.	Cost of Feed.	Profit.	Cost of Butter per pound.
	lbs.	lbs.				Cents.
AYRSHIRES.						
Kirsty Wallace of Auckenbrain 8301	6,469·70	292·31	73·07	27·74	45·33	9·81
Lady Flora of Orchardton 12216 ...	6,826·30	265·51	66·38	27·68	38·70	
Alice 2nd of Lessnessock 9161 ...	6,127·90	282·15	70·53	28·29	42·24	
Betsy 1st of Fairfield Mains 12284 ...	7,041·50	298·57	74·63	28·57	46·06	
Pearl of Woodside 7420	6,730·80	296·07	74·01	28·56	45·45	
Total	32,996·20	1,434·61	358·62	140·84	217·78	
BROWN SWISS.						
Lucy	6,356·20	258·13	64·53	31·01	33·52	11·14
Nikola	6,220·80	238·12	59 52	29·18	30·34	
Eliza	6,417·90	286·89	71·72	31·13	40·59	
Belle T.	5,789·00	278·45	69·61	28·38	41·23	
Hope of Minnesota	6,117·00	259·85	64·96	27 61	37·35	
Total	30,901·50	1,321·44	330·34	147·31	183·03	
GUERNSEYS.						
Vega	5,029·10	271·64	67·90	26·16	41·74	9·31
Cassiopiea	6,270·10	315·01	78·75	28·33	50·42	
Mary Marshall	5,611·00	354 26	88·57	29·16	59·41	
Madora Fern	4,224 80	214·87	53·72	24·36	29·36	
Procris of Paxtang	5,992·60	313·10	78·27	28·78	49·49	
Total	27,127·60	1,468·88	367·21	136·79	230·42	
FRENCH CANADIANS.						
Liena Flory 3840	5,458 00	252·54	63·13	23·72	39·41	9 76
Rouen 589	4,896·10	257·20	64·30	23·68	40·62	
Denise Championne 5330	5,404·20	256·63	64·15	23·52	40 63	
Luna 4852	5,048·50	225·03	56·26	23·52	32·74	
La Bouchette 5351	3,849·60	166·38	41·59	18·65	22·94	
Total	24,656·40	1,157·78	289·43	113·09	176·34	
HOLSTEINS.						
Meg	7,361·00	282·84	70·70	34·00	36·70	10·93
Tidy Abbekirk 1492	7,659·10	296·00	73·99	32·87	41·12	
Inka Mercedes De Kol 1828	8,028·30	288·34	72·08	32·37	39·71	
Hulda Wayne's Aagie 2574	8,040·70	305·79	76·44	32·33	44·11	
Beauty of Norval 1404	8,140·70	328·01	82·00	32·57	49·43	
Total	39,229·80	1,500·98	375·21	164·14	211·07	
DUTCH BELTED.						
Alberta	3,916·60	142·42	35·60	24·11	11·49	13·27
Madeline	5,661·00	215·26	53·80	26·66	27·14	
Belle of Warwick 2nd	5,313·20	259·80	64 95	26·93	38·02	
Merletta	4,715 40	170·03	42·50	27·45	15·05	
Holland Creamery	5,287·30	209·51	52·37	27·21	25 16	
Total	24,883·50	997·02	249·22	132 36	116 86	

Now, as to the part the *Jersey Bulletin* has taken in this test, I am pleased to say that Mr. Van Alstyne, Mr. Converse, the Pan-American live stock superintendent; Mr. McManus, the assistant superintendent of live stock and agriculture; Mr. E. B. Elderkin, the Canadian live stock superintendent, and other officials have on various occasions complimented the *Jersey Bulletin* for the excellent and concise manner of reporting the Model Dairy news.

Among the herdsmen—"the men behind the cows"—the *Jersey Bulletin* has been a source of pleasure and assistance, several of

them having the *Bulletin* mailed to their principals to spare them the trouble of writing reports. As one of them remarked, "It is as correct and as nearly 'official' as anything published, and not so full of glaring errors and misstatements as some who claimed to publish the 'best and only news of the Model Dairy test.'"

"The *J.B.* Man on the Spot" has ceased to exist; he is no more; but he trusts that the officials and the "boys" of the Model Dairy, to whom he is indebted for many courtesies and kindly assistance, may remember him as a man prone to err, but always willing to correct or retract an erroneous statement; and withal having for them the kindliest feelings and regretting that the pleasant intercourse he has had with them during the life of the Pan-American Exposition is now ended.

May their remembrance of "The *J.B.* Man on the Spot" never be otherwise than pleasant.—[*Jersey Bulletin*].

INSECT PESTS ACT.

MONTHLY REPORT.

In addition to the work of examining orchards and gardens in the vicinity of Perth, to see that all fruit infested by Fruit Fly is gathered and destroyed, inspections have been made of 60 orchards in the following districts:—Newcastle, York, Katanning, Kojonup, Donnybrook, Jarrahdale, Kelmscott, Smith's Mill, Guildford, and Fremantle. As but little fruit is now left in the gardens around Perth, the Fruit Fly pest has, in a large measure, disappeared, though fruitgrowers who have any citrus fruits should carefully watch their fruit for the presence of the fly, and regularly gather all fallen fruit from the ground. The fruit of the prickly pear is often attacked by the fly, therefore fruitgrowers should take warning and not permit this plant to grow in or near their gardens to provide a harbour for this pest. Another plant which the orchardist might well decline to allow to grow near his premises is the common apple of Sodom (*Solanum Sodomæum*), as this plant also bears a fruit which may be utilised by the fly as a food. The majority of the orchards inspected in the country districts were found to be in a thoroughly satisfactory condition, but the presence of the San José Scale was discovered in seven of them, a total of 434 trees being affected; one orchard which had not previously been inspected being found to contain 135 trees affected with this disease. A number of the affected trees have already been treated by fumigation, and the remainder will be similarly dealt with as soon as possible. Seven other orchards, in which this disease had been discovered formerly, were examined and found to be clean.

All fruit passing through the auction rooms in the city and offered for sale in shops is subjected to regular examinations at the hands of an inspector, who condemned 74 cases during the past month, principally on account of being infested by the larvæ of the Fruit Fly. Some oranges and lemons badly infested with red scale were also condemned. As citrus fruits will soon be coming forward in quantity, I would advise growers to carefully pick their fruit, so that the good and bad may not be destroyed together. If a case of oranges offered for sale contains half clean and half badly diseased fruit, the inspector has no option but to condemn the whole case. A few scaly fruits are sufficient to spoil the appearance of a case, and it often happens that the clean fruit in a case would realise more money than it does with the addition of the dirty stuff. Many of our fruitgrowers, in failing to grade their fruit and pack it in an attractive manner, are simply robbing themselves, for their fruit would invariably command higher prices if shown to advantage.

The importations of fruit during the past month has amounted to 5,016 cases at the various ports, and of this quantity only 62 cases were destroyed on account of disease, a fact which proves that a much better and cleaner class of fruit is being shipped than formerly; a satisfactory condition of affairs, mainly attributable to the strictness of the inspection at the ports, which diseased fruit has little chance of passing.

G. BUCHANAN,
Chief Inspector.

9th May, 1902.

HEIFERS: THE BEST BREEDING AGE.

By W. J. Cother, G.M.C.V.S., *in the Agricultural Journal of Victoria.*

This is a question that has exercised the minds of dairymen, and about which there has been some controversy. Some advocate early breeding, whilst others maintain that a heifer should not breed earlier than three years old.

The opponents of early breeding argue that the physical development of the animal is arrested, which is a fact so far as it goes; but it must be remembered that although of great importance, physical development is not the main desideratum in the growth of the dairy cow, the chief end of whose existence is to yield milk, and to attain that object it is necessary that the milk vessels should be developed. This may not be the case if too much importance is attached to the production of large-framed animals.

In discussing this question it must be borne in mind that the dairy cow as we know her to-day is the result of a process of selection and the development of a particular organ, which has reached abnormal proportions.

Milk is a desirable and necessary food for man, and the cow has been selected to supply his requirements.

In a natural state she is only required to yield milk sufficient for the support of her offspring, but man, having made a greater demand on milk yielding faculties, she now produces a supply far in excess of a calf's requirements, thus demonstrating that where a demand is made upon natural functions a response will be made to that demand even to a degree that amounts to a condition of disease. It follows, therefore, that in this as in other directions the natural powers must be trained early in the channel in which those powers are to run. In a heifer intended for dairying purposes, this is effected by her early assumption of the maternal functions. On the other hand, if she is not allowed to breed early it will be found that she has developed physically in the direction of producing beef instead of milk.

In a heifer in calf at an early age, when she is in course of development, the developing process will be directed to the parts making the greater call on the system, in this case the hind-quarters, for the development of the fœtus, the preparation of those parts for the expulsion of the fœtus, and to the udder for the support of the calf. The development of the hind-quarters will arrest the development of the fore quarters, and the heifer will be fine in the neck and withers. The reverse is the case of a maiden or barren heifer—she has a tendency to become thick in the withers and neck, and inclines to bull-headedness.

The early assumption of the sexual functions stamps the animal with the characteristics of its sex. On the other hand, the deprivation or absence of the sexual functions or organs gives the animal the characteristics of the opposite sex, *e.g.*, the barren heifer becomes masculine, and the emasculated young bull becomes more feminine in appearance.

I think that all the evidence, theoretical and practical, goes to prove that it is desirable that dairy heifers should breed at two years old, the conditions of pastures and climate being favourable. If that is conceded, the question arises which is the most suitable season that heifers should come in? That would vary in different districts. On fair to good summer country, I think autumn the best time, for the reason that the heifer in calf has the advantage of genial weather and good pastures, consequently her condition and growth do not suffer.

The heifer having calved, to make a good cow she should be well fed, and, if her condition holds, milked on for, say, nine months, and should not calve for the second time until fifteen months after the first calving.

Young heifers should be put to a young or very light bull. From the use of large-framed heavy bulls many heifers have been rendered delicate for life, either by being hurt in the service or the calf so large as to render calving difficult.

DAIRY COWS.

The quantity of milk yielded by a cow depends primarily on its milk-yielding capacity. The question of food is only of secondary but still of vital importance, while the general management of the cow also has a beneficial or adverse effect—according to whether it is correct or otherwise—on the milk yield. Other factors influencing the quantity of the milk yield are the age of the cow, the milk yield generally being greatest after the cow has had her third calf, and secondly the time of the period of lactation; at the beginning of this a larger quantity of milk is yielded than towards the end, as the cow dries off. The operation of milking itself also influences the quantity of milk; a good milker will draw a larger quantity of milk from a cow than will a poor and inexperienced milker. This last point is frequently overlooked, though it is very important. Especially in the case of young cows, great stress should be laid on having them milked by an experienced milker, and that the milking is not performed in a slipshod manner. In a large herd of dairy cows the extra quantity of milk produced by employing good and experienced milkers as compared with careless ones is not inconsiderable. By milking cows three times a day a larger quantity of milk is obtained than if they are milked but twice daily. In regard to this point, however, it must be remembered that considerably more labour and expense is involved by milking three times in the day, and in many cases it may be questionable whether the additional quantity of milk obtained by doing so covers the extra expense incurred. In many instances, also, it would be impracticable to arrange for the cows to be milked three times daily. In the case of heifers with their first calf, the practice of milking them twice daily would favourably influence their milk yield in succeeding years. This last, of course, applies only to such cases where the calves are taken away from their dam immediately after birth.

All these various factors mentioned as influencing the yield of milk in a beneficial or adverse manner are, however, of minor importance. As already pointed out, the question of the milk yield of a cow depends chiefly on her inherent milk-yielding capacity. This is a hereditary quality, and such being the case, the milk-yielding capacities of a herd of dairy cows can largely be increased by careful selection and breeding. In herds where a large milk yield is desired, special stress must, therefore, be laid on drafting into the herd only those heifers which have been bred from the best or at any rate good milkers. The heifer calves of bad or indifferent milkers should on no account be retained, as they will have inherited the poor milking qualities of their dams. By selecting the heifers as just described, and continuing this process for a sufficient length of time, the average milk yield of the herd will be considerably increased. It is not enough, however, to ensure that the dams of the calves retained for drafting into the herd are good

milkers. Great weight should be laid on using a bull that has been bred from a deep-milking cow. This point is too frequently overlooked. While in many herds the selection as far as regards the dams of the heifers retained for drafting into the herd is judiciously carried out, little or no attention is bestowed on the question whether the bull used for serving the cows comes of a deep-milking family and has a heavy milker for his dam. On the contrary, not infrequently entirely unsuitable bulls are used in dairy herds; bulls, it is true, which perhaps have a pedigree, and which would please the eye of a judge, but whose services in a dairy herd had better be dispensed with. The use of a bull whose immediate female ancestors were or are poor milkers in a dairy herd is much more to be deprecated than the breeding from a poor milking cow and retaining the produce. The bull, it must be borne in mind, influences the milking qualities of all the heifers in a herd. Unless, therefore, the breeding of the bull used for service in the herd is attended to, but little and uncertain progress can be made in the improvement of the milking capacities of the heifers bred. In fact, by breeding from a bull descended from a poor milking family, the benefit accruing from retaining for breeding purposes only good milking cows are to a greater or less extent negatived, according to the degree of prepotency of the bull. Only if both parents are descended from good milkers can it be expected that the progeny will be a good milker if a heifer calf, or get deep-milking heifers if a bull calf.

Breeding from a good milker whose parentage is unknown will not invariably ensure calves which later on will also give a large milk yield. Breeding from animals whose parentage is unknown and which are crossbred, must at best be but guesswork and uncertain in its results, as is most in evidence in the breeding of horses. We may have a cow which is a deep milker, yet her heifer calves may fail to possess the same desirable quality. In most cases, and as a rule, however, it will be found that good milking cows produce equally good milking heifers, provided they have been bred to a suitable bull, as pointed out above. This is due to the fact that deep milkers generally come from good milking families, and that their milk-yielding capacity is an inherited quality and not of accidental appearance; if the latter were the case, it would not for certain be transmitted to the offspring.

In selecting the cows from which to breed heifer calves for drafting into the herd, the best test of their usefulness and suitability is, of course, to keep a careful record of their daily milk yield, as is at the present day done in many herds. In fact, it is absolutely necessary to follow this plan if satisfactory results are to be obtained, although it cannot be denied that some extra trouble is involved thereby. At the same time, the benefit resulting from knowing the actual milk record of each cow in the herd amply justifies the extra trouble and labour entailed. In all cases, it is the most satisfactory and simplest way to weigh the milk; simple and inexpensive weighing machines for this purpose are found on the market at the

present time. In converting pounds of milk into gallons, or *vice versa*, we may take it as accurate that ten pounds equal one gallon.

Good milch cows possess certain outward characteristics, which to some extent aid us in forming an opinion as to their suitability for the dairy. Yet this point is of minor importance; an accurate result as to the milking capabilities of a cow can only be gained by keeping a milk record. The characters of a good milk cow are, of course, common to a greater or less extent to all cows belonging to dairy breeds or crossbred cows produced by crossing the former. Although we are able to distinguish to some extent, by means of the outward conformation, a cow likely to be a fairly good milker from one which is a poor milker, yet it is impossible to say by judging from the outward appearances of a cow and the size of the bag, etc., whether she will give 500 gallons or 900 gallons of milk per annum. This fact can alone be established by carefully recording her daily yield.

The size of the bag is, of course, one of the chief points in judging of the usefulness of a cow for dairy purposes; size, however, is not the only point, the texture is also of importance. By no means are the size and texture of the bag an infallible guide as to the milk-yielding capacity of a cow, although it is not infrequently assumed to be so. The shape and size of the bag of course vary in different breeds; even among the various dairy breeds uniformity in regard to this point does not exist. On the contrary, the dairy breeds in this and other countries possess bags of different types. As an example, the typical udder of an Ayrshire cow may be cited, which is quite different to that of a dairy Shorthorn cow, though both are good milkers. The size of the milk veins also, to some extent, is an indication of good milkers.

Other characteristics which invariably indicate good dairy cows are the following:—A wedge-shaped body, a smallish head, comparative narrowness of the body in front and wideness behind; large, roomy belly, wide and projecting hips, and a skin of good texture.

A dairy cow is not, however, a good milker because she possesses the characteristics just mentioned. It is the other way about—that is to say, because a cow is a good milker, therefore she possesses those points which we are accustomed to look for in a dairy cow. In breeding dairy cows chief stress must, therefore, be laid on the actual milk yield. If this is done, the outward points which characterise the build of a good milker will not fail to appear. To breed dairy cattle from their outward conformation alone is eminently wrong, and can never tend to improve the herd as far as milk-yielding capacity is concerned.

As pointed out at the beginning of this article, the feeding of dairy cows is of secondary importance when compared with the question of the individual milk-yielding capacity of a cow. At the same time, of course, the question of feeding is a very important one, and its importance cannot be over-estimated. Putting it shortly, we may say that only those cows will respond to liberal feeding by giving an increased quantity of milk which are really good milkers and possess good milk-yielding capacities. Cows, on the other hand,

which are not naturally deep milkers can never be made so by feeding, be they fed on ever so suitable a food. In their case the food supplied would not be converted into milk—as is done in the case of good milking cows—but it would be stored up in the body in the form of fat, while the nitrogen of the food would appear in the urine, unless it also is stored up in the body in the form of flesh. This explains the fact why the food of a dairy cow—meaning thereby a cow belonging to a dairy herd, irrespective of the question whether she is a good milker or a poor one—is but of secondary importance, although it is frequently looked upon as of chief and sole import. Naturally good milkers will, even on poor food, not sink below a certain minimum in their milk yield. By liberal and judicious feeding it may considerably be increased, and the maximum yield will be reached when they are fed in the most suitable manner.

In discussing the above points, we were only considering the case of dairy herds where the production of milk is the sole object. Where cows are bought and drafted into dairy herds, and later on sold to the butcher when they cease to give a satisfactory quantity of milk or dry off, other points in regard to the feeding must be considered.

The general management of dairy cows also affects their milk yield. Any adverse factors in the management which tend to a reduction in the milk yield will have a much more marked influence on deep milkers as a rule than on cows possessing but poor milk-yielding capacity. The greater the milking powers of a cow are developed, the more easily will they be adversely affected by unsuitable conditions.—"F.," in the *Live Stock Journal.*

BROADCAST SOWING.

Farmers in districts where the drilling of corn is all but universal would probably be surprised to learn the extent to which broadcasting is still practised. It is still by far the most common system in parts of Sussex, if not in that county as a whole; the work being done by hand. More surprising is the statement made by Mr. Speir, in his article on "The Seeding of Grain," in the Journal of the Board of Agriculture:—"In the best farming districts of Scotland," he says, "land drills are used on a few farms, and broadcast sowing machines on others; but the great bulk of grain is there sown by hand. In some districts the custom is to sow with one hand, but throughout a large part of the country the prevailing method is to use both hands." Mr. Speir adds that the small extent to which the grain drill is used in Scotland is in great part accounted for by the damp and fickle climate, which necessitates pushing on the work when a favourable opportunity occurs. There is, as he says, a considerable waste of seed in broadcasting, three-quarters to one bushel more wheat, and one to one and a-half bushel more barley or oats per acre being needed in broadcasting than in drilling.—*Agricultural Gazette.*

EXPERIMENTS IN THE PREVENTION OF STINKING SMUT OR BUNT OF WHEAT.

By D. McAlpine, *in the Agricultural Journal of Victoria.*

The experiments during the past season were confined to the three principal substances which are known to prevent the germination of the bunt spores, and the relative effects on the germination of the grain were carefully noted. The substances used were bluestone, corrosive sublimate, and formalin.

The same variety of seed-wheat was used in all the plots, viz., Queen's Jubilee, and infected with the spores of the fungus; the smut balls being taken from a very dirty sample, crushed up, and thoroughly mixed with the grains to be sown.

The bluestone solution was made at the rate of 1lb. sulphate of copper to five gallons of water, and the infected seed was dipped in this solution for one minute, and then spread out to dry before sowing.

The precautions to be taken in pickling are to see that the bluestone is of the right quality, and not the impure substance sold as agricultural bluestone, and adulterated with sulphate of iron; that the seed is thoroughly wetted; and that the pickled wheat is not contaminated again by being placed in bags which have had bunted grain in them.

The well-known antiseptic corrosive sublimate was dissolved in water at the rate of 1lb. to 100 gallons, and the infected seed dipped in it for three minutes, and sown after drying. It dissolves more quickly in hot water, and takes some time even then.

Formalin of the trade is a 40 per cent. solution of formaldehyde, and this was used at the rate of 1lb. to 50 gallons of water, and 1lb. to 100 gallons. The seed was soaked for ten minutes, and then sown after drying.

After treatment, 1,000 grains were sown in each plot, then the number of plants were counted after germination, and finally the bunted plants were carefully looked for at harvest time.

The accompanying table shows the result of the treatment and its effect upon the germination of the grain. In each of the treated plots there was no bunt, while in the check plot alongside of the others only 5 per cent. of plants were clean.

As regards germination, however, the highest percentage was obtained in the untreated plot, viz., 96, thus showing that in checking the germination of the spores of the fungus the grain is also injuriously affected. The corrosive sublimate came next with a percentage of 71, the two formalin solutions 62 and 69 respectively, and the bluestone was the most destructive of all to the grain, only 46 per cent. germinating.

In order to test the efficacy of the treatment on a larger scale, half-acre plots will be sown next season under similar conditions,

and the results should show conclusively which of these three solutions are the best for the prevention of stinking smut in ordinary field crops. In addition, the new fungicide "sar" (essentially sodium sulphide), recommended by the United States Department of Agriculture, will be given a trial.

TABLE I.—RESULTS OF TREATMENT FOR BUNT.

Treatment.	Grains Sown.	Grains germinated.	Percentage of germination.	Percentage of Bunted Plots.	Cost of Treatment per 50 gallons.
Bluestone, 1lb. to 5 gals. of water	1,000	459	46	...	3s. 4d.
Corrosive sublimate, 1lb. to 100 gals. of water	1,000	712	71	...	2s.
Formalin, 1lb. to 50 gals. of water	1,000	621	62	...	2s. 6d.
Formalin, 1lb. to 100 gals. of water	1,000	692	69	...	1s. 3d.
No treatment	1,000	960	96	95	...

CORRESPONDENCE.

AGRICULTURAL SOCIETIES.

MEETING NIGHTS.

The Director of Agriculture, Department of Agriculture, Perth.

SIR,—The list of Agricultural Associations at the end of the *Journal*, with secretary's name, is of great benefit to us when wishing to communicate with other associations, but if possible the night on which the various associations assembled could be inserted, it would be of still more value, as, should any of our members or those of other associations desire to attend the meeting, they could time their visit so as to embrace the meeting night.

I might also suggest that a note be placed in the *Journal* suggesting that all members of associations should have a card of membership issued yearly, and that such members be hon. members of other associations.

I am, yours etc.,

CHAS. A. SHAW,

Hon. Sec. Wanneroo Farmers' and Gardeners' Association.

6th May, 1902.

[The suggestion made by our correspondent is a good one, and we invite the secretaries of societies to send in the dates of their respective meeting nights, when they will be published in the *Journal*.—ED. *Journal*.]

MARKET REPORT.

For Month ending 9th May, 1902.

The West Australian Farmers' Co-operative Company, Limited, City Markets, Perth, report sales in undermentioned lines for month ending 9th May, 1902, as follows:—

Farm Produce.—Chaff market has been gradually firming during the month. We now report an advance of 10s. per ton on all prime lines; prime quality now worth £4 5s. to £4 10s. per ton; medium and fair quality £3 10s. to £4 per ton; inferior chaff, £3 to £3 5s. per ton. A large portion of chaff coming to hand has been too ripe when cut; buyers readily pay 10s. per ton extra for good green samples. Millers' lines: flour, bran, and pollard, have all taken a substantial rise during the month. Prices now ruling:—Bran, £9 2s. 6d. to £9 5s. per ton; pollard, £9 5s. to £9 7s. 6d. per ton; flour, prime local, £10 10s. to £11 per ton; oats, Algerian, 3s. 10d. to 4s. per bushel, stout oats, 4s. 4d. to 4s. 7d. per bushel. Wheat.—Market still advancing; very few samples offering, price, 5s. 3d. to 5s. 8d. per bushel. Potatoes.—We are pleased to observe the large increase in supply of local crop; there should be no necessity to import potatoes into this State. All prime samples are quickly disposed of at £9 10s. to £11 per ton. Seed potatoes.—Demand quiet, £10 to £10 10s. per ton. Onions.—The demand is quieter here, £10 10s. to £11 per ton.

Dairy Produce.—Prime local butter, scarce, 1s. 8d. to 1s. 10d. per lb. Bacon, 10½d. to 11½d. per lb. Cheese, 9½d. to 10d. per lb. Eggs.—This line has fluctuated considerably. Prices have gradually receded from 3s. per dozen; value now 2s. to 2s. 2d. per dozen. Honey, 12s. 6d. to 15s. per 60lb. tin.

Fruit.—Local fruit becoming very scarce. Grapes may now be considered finished; those offering lately realising 5s. to 9s. per case; 10s. 6d. to 11s. for special lines. Apples: Satisfactory prices for all good lines; desert varieties, 11s. to 16s. per case; cooking apples, 8s. to 9s. per case; pears, 9s. to 22s. 6d. per case; pomegranates, 5s. to 7s. per case; quinces, 6s. to 7s. 6d. per case; water melons, 4s. to 6s. per dozen.

Vegetables.—Cabbage more plentiful; best quality 5s. to 7s. per cwt.; medium lines 3s. to 4s. per cwt.; beans 1d. to 1½d. per lb.; peas 3d. to 4d. per lb.; ironbark pumpkins, £6 to £6 10s. per ton; swedish turnips, £6 10s. per ton; pig melons, 30s. to 40s. per ton; tomatoes, 5s. to 6s. 6d. per case; cauliflowers, 6s. to 9s. per doz.; rhubarb, 2d. to 2½d. per lb.; carrots and parsnips, 1s. 9d. to 2s. per doz. bunches; turnips, 1s. to 1s. 6d. per doz. bunches.

Poultry.—Largely increased quantities offering, owing to high price of feed. Prime table fowls, 5s. to 6s. per pair; chickens, 3s. to 5s. per pair; ducks, scarce, 6s. to 7s. 9d. per pair; geese, 12s. to 15s. per pair; turkey gobblers, 18s. to 22s. per pair; lighter birds, 15s. to 17s. per pair; turkey hens, 10s. to 12s. per pair. We have lately sold several lines of pure-bred fowls at satisfactory prices. We have unlimited demand for pure-bred fowls, especially minorcas, brown and white leghorn breeds.

Live Stock.—Pigs: Prime porkers, 30s. to 38s. each; forward stores, 25s. to 28s. each; backward stores, 12s. to 20s. each; sucking pigs, very dull of sale, 5s. to 8s. each; well bred sows, £3 to £5 each. Sheep, 18s. to 21s. each.

Carcase Meat.—Prime porkers, 6½d. to 7d. per lb.; heavy weight pork. 4½d. to 5½d. per lb. Mutton, 5¼d. to 5½d. per lb. Beef, 5¼d. to 5½d. per lb. Veal, 5½d. per lb.

Sundries.—Oilcake, £8 10s. to £8 15s. per ton. Bran sacks, 4s. 3d. per doz. Bales, 4s. per doz.; second hand, 2s. 9d. per doz. Corn sacks (new), 5s. 9d. per doz.; second hand, 3s. 9d. per doz. Thomas's phosphate, £4 10s. per ton. Bonedust, £7 5s. to £7 10s. per ton.

GARDEN NOTES FOR JUNE.

By Percy G. Wicken.

In all probability, before these notes are published we shall have had a good supply of rain, and the ground will be getting wet and cold, and therefore all garden work should be pushed on with, and as many seeds as possible should be planted so as to get the benefit of the early rains. The soil is warm when the rains start, and as soon as the seeds get the warmth and moisture they make a rapid growth, but take much longer to germinate when the ground becomes cold. All autumn-sown seeds should be sown in time to benefit by the early rains. The early frosts will, in most districts, kill the few remaining tomato or French bean plants that may still be bearing; but there should be a good supply of cabbages, cauliflowers, broad beans, kale, etc., coming on for the winter. All these plants are improved rather than hurt by a light frost. In the higher and well-drained portions of the State these vegetables should be plentiful, while the swamp land will be getting too wet to yield good results. In all rich humus and garden soils, which have been well manured for some time past, the application of a dressing of caustic lime will prove of benefit. The lime acts on the vegetable matter in the soil and makes a quantity of the nitrogen contained in the humus available for plant food; it also liberates a quantity of potash from its various compounds, so that the plants can absorb it. Lime is not required as a manure in itself, but makes the manurial ingredients in the soil more readily available.

A liberal supply of manure is required to make the crops grow quickly, and to give the best results. A list of the names required for different crops was published in the January issue of the *Journal.* Turnips and swedes require plenty of superphosphate. Potatoes, plenty of potash and nitrogen. Peas and beans, superphosphate and potash. Cabbages and cauliflowers are greatly improved by a dressing of sulphate of ammonia, spread along the rows at the rate of from 1cwt. to 2cwt. per acre.

Asparagus.—Get a trench dug and well manured ready to plant out the roots early in the spring.

Broad Beans.—Sow a few rows every week, so as to keep up a succession and have a plentiful supply of fresh green beans coming on.

Cabbages.—Sow a little more seed so as to have some plants coming in for future use. The seed should not be sown thickly in the beds, as this causes the plants to grow long and spindly, and after transplanting they either die off or take a long time to recover. The seeds, even in the beds, are better sown in drills, and they can then be thinned out and healthy plants obtained.

Cauliflowers.—Sow a few seeds for future transplanting, otherwise treat the same as cabbages. Cauliflowers require to

grow quickly and without any check. The application of liquid manure is of great benefit to them.

Carrots.—Sow a few rows of the shorthorn variety in drills about one foot apart, and one inch deep; thin out those already coming up, and keep the beds free from weeds.

Celery.—Plant out in a trench, which has been well manured, any plants you have available; those that are farther advanced should be well earthed up, in order to blanch them and make them tender, but no earth must be allowed to get into the heart of the plant.

Leeks.—Plant out any young plants you may have and sow a further supply of seed in a seed bed, which should be planted out as soon as the plants reach six to eight inches in height. Leeks should be planted out in shallow trenches, first trimming off their roots and slightly cutting back their leaves.

Lettuce.—Sow a little seed in seed bed and plant out any seedlings you may have ready. They should be planted about one foot apart each way. The distance will vary with the variety.

Onions can still be sown in seed beds, and those seedlings which have grown sufficiently can now be planted out. Onions should n t be planted too far apart, unless large-sized ones are required. The drills should be about one foot apart and the plants from six to eight inches apart in the rows.

Peas.—Sow a few more rows to keep up a succession, or a larger area if growing for market. Pull up all old plants which are not bearing well and sow something fresh.

Turnips.—A further supply may still be sown, and those plants already up will require to be thinned out. The young ones are very acceptable for the table, and may be thinned out of the bed as required for use.

Radish.—Sow a little seed from time to time. This vegetable is splendid for the table if quickly grown, but if of slow growth is tough and indigestible. It requires plenty of good liquid manure to force it along.

Farm.—All available hands should be at the business of ploughing, preparing the land, and sowing the cereal crops; the early-sown crops almost always give the best results. Those who have large areas of fallow ground are able to get most of their sowing done early in the season, while those who have to wait for rain before they are able to commence their ploughing are dependent on the weather, and are a good deal later in getting their crops sown. Much better results are to be obtained by fallowing all wheat land in rotation, than by continuously cropping it year after year without a change. The application of phosphates of lime as a manure will, in most of our Eastern districts, prove of benefit, and turn out to be a profitable investment. Lucerne is a very valuable crop, and could be successfully grown in many of our districts. The roots penetrate the soil to a great depth in search of water, and

when once established, will resist to a great extent the dry weather, and yield a heavy supply of succulent fodder during the hot weather. It deserves much more attention from the hands of our farmers than it has yet received. *Paspalum Dilitatum* and *Paspalum Virgatum*, both roots and seed, may be planted during the present month, and will obtain a fair root-hold before the hot weather comes on them, and give a much heavier yield next summer than if sown in the spring. If the sowing of these grasses are left too late, there is a possibility of the ground being too cold for the seed to germinate. If the soil is becoming too wet, plough-furrows should be run round the headlands, and also through the paddocks if necessary, following the fall of the land, so as to enable as much of the water as possible to get away. Stagnant water is very injurious to almost all crops.

THE CLIMATE OF WESTERN AUSTRALIA DURING APRIL, 1902.

This month was characterised by fine weather throughout the whole of Australia. Atmospheric pressure remained persistently high in the neighbourhood of the South coast, especially in the Eastern States. There were signs of an occasional "low" passing from W. to E., but these kept well to the Southward, and brought a few showers to coastal districts only. In Perth the weather was, on the whole, delightful, with a mean maximum temperature 2½degs. above that for previous years. Throughout the interior it was remarkably warm, the mean maximum temperature being in some cases nearly 10degs. in excess of the average for the past few years. With the exception of the South coast, scarcely a drop of rain fell throughout the State, and even on the coast the total was far below the average.

On the 30th a "low" was indicated off the Leeuwin, which on the next day brought in the commencement of the winter rains.

From the following table of terrestrial minimum temperatures it will be seen that in the South-West interior districts the thermometer has already reached frost level:—

TERRESTRIAL MINIMUM TEMPERATURE.

	Mean.	Lowest.	Date.
Cue	55·1	49·0	25
Coolgardie	50·2	39·0	28
Southern Cross	47·4	39·0	28
Walebing	47·1	40·0	24
York	46·2	37·8	28
Perth Observatory	50·9	41·6	26
Bridgetown	40·6	26·9	28
Karridale	48·5	36·5	28
Katanning	41·7	28·0	25, 26, 28

The Climate of Western Australia during April, 1902.

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					April, 1902.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
NORTH-WEST AND NORTH COAST:															
Wyndham ...	29·903	29·897	30·090	29·748	97·0	76·7	86·8	100·5	69·2	97·9	77·1	113·0	63·5	28	2152
Derby	29·913	29·912	30·069	29·800	97·7	67·1	82·4	101·0	57·2	95·9	71·8	106·0	49·0	*Nil*	1477
Broome ...	29·930	29·914	30·092	29·781	94·9	68·8	81·8	100·1	61·0	93·6	70·9	102·4	55·0	30	2047
Condon ...	29·961	29·948	30·160	29·817	94·3	62·0	78·2	100·0	53·5	89·2	66·5	103·0	51·0	*Nil*	1980
Cossack ...	29·991	29·940	30·146	29·821	94·6	67·6	81·1	102·3	59·9	90·2	72·1	105·0	61·0	*Nil*	1250
Onslow ...	29·974	29·976	30·144	29·814	93·7	64·7	79·2	103·0	59·0	92·5	66·4	106·0	53·0	*Nil*	312
Carnarvon ...	30·018	29·976	30·202	29·847	86·8	66·9	76·8	103·5	58·6	86·2	64·0	108·0	46·0	*Nil*	416
Hamelin Pool...	30·023	30·008	30·188	29·825	92·3	60·9	76·6	99·0	57·0	85·0	62·3	105·6	50·0	*Nil*	112
Geraldton ...	30·082	30·070	30·304	29·845	78·2	58·2	68·2	89·3	52·3	78·6	59·0	100·0	42·0	1	46
INLAND:															
Hall's Creek ...	29·997	...	30·211	29·808	92·6	59·3	76·0	98·6	47·0	...	...	...	...	*Nil*	1369
Marble Bar ...	...	...	...	...	98·8	65·7	82·2	104·0	53·2	...	...	...	...	*Nil*	1108
Nullagine ...	29·999	...	30·196	29·758	93·9	56·4	75·3	99·0	45·0	88·8	62·0	99·8	41·0	*Nil*	1194
Peak Hill ...	30·029	...	30·238	29·811	88·8	62·8	75·8	94·3	54·0	82·5	61·9	95·8	53·0	*Nil*	1459
Wiluna ...	...	...	...	...	...	...	...	...	...	...	...	...	...	*Nil*	969
Cue	30·046	30·042	30·290	29·799	91·6	61·6	76·6	98·8	54·9	83·8	60·3	101·0	41·0	*Nil*	627
Yalgoo ...	30·051	30·050	30·295	29·730	89·9	58·1	74·0	98·2	51·0	83·0	58·9	102·5	42·3	3	343
Lawlers ...	30·064	30·062	30·330	29·812	87·7	59·0	73·4	96·4	49·7	80·3	58·2	94·3	39·4	*Nil*	594
Laverton ...	30·088	...	30·273	...	86·4	57·0	71·7	99·9	47·6	...	...	...	...	*Nil*	496
Menzies ...	30·082	30·092	30·331	29·739	85·5	59·9	72·7	95·8	52·8	78·0	55·5	98·0	37·0	*Nil*	621
Kalgoorlie ...	30·134	30·105	30·425	29·790	85·6	57·7	71·6	96·3	48·0	76·5	54·6	95·4	38·8	*Nil*	350
Coolgardie ...	30·106	30·103	30·392	29·761	85·3	56·1	70·7	97·9	45·6	76·4	53·7	96·1	39·1	4	264
Southern Cross	30·068	30·084	30·334	29·724	86·2	52·1	69·2	97·8	45·5	76·8	50·9	98·0	31·7	*Nil*	392
Walebing ...	...	...	...	...	83·7	51·9	67·8	94·0	44·0	...	...	...	...	*Nil*	18
Northam ...	...	...	...	...	83·2	51·0	67·1	93·0	40·0	...	...	...	...	*Nil*	39
York	30·112	30·103	30·353	29·811	84·4	49·7	67·0	92·2	39·2	76·2	52·3	100·2	34·5	*Nil*	2
Guildford ...	...	...	...	...	81·9	52·4	67·2	94·0	46·0	...	...	...	...	28	48

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Climate of Western Australia during April, 1902—*continued*.

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					April, 1902.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
South-West and South Coast:															
Perth Gardens	30·120	30·108	30·355	29·808	79·2	55·8	67·5	87·9	49·1	77·6	54·9	106·5	41·0	19	40
Perth Observatory	30·130	30·098	30·352	29·841	77·8	56·4	67·1	88·0	50·8	75·2	56·7	97·4	42·4	22	41
Fremantle ...	30·116	30·090	30·328	29·844	75·2	59·5	67·4	84·2	53·2	73·7	57·7	93·6	43·0	30	39
Rottnest ...	30·120	...	30·324	29·843	73·6	62·0	67·8	81·4	55·6	74·8	58·7	92·5	47·8	33	40
Mandurah ...	...	...	...	...	77·3	51·9	64·6	85·6	40·4	...	...	...	...	15	48
Wandering ...	...	...	...	...	77·9	44·6	61·2	84·0	33·0	...	...	..	...	2	18
Collie	...	...	...	...	76·6	42·5	59·6	85·3	32·0	...	...	...	...	18	68
Donnybrook ...	...	...	...	...	77·0	48·2	62·6	86·7	35·4	...	...	...	...	14	105
Bunbury ...	30·140	30·110	30·351	29·821	73·4	53·8	63·6	79·8	41·0	72·0	53·0	91·0	37·3	22	58
Busselton ...	...	...	...	...	74·0	49·5	61·8	80·5	39·0	...	...	...	...	43	61
Bridgetown ...	...	...	...	...	76·4	43·7	60·0	85·0	30·0	...	...	...	...	27	76
Karridale ...	30·128	30·110	30·321	29·744	71·7	53·0	62·4	81·0	40·0	70·9	52·0	92·0	36·8	96	239
Cape Leeuwin	30·111	30·070	30·319	29·647	71·9	61·2	66·6	82·2	56·5	69·0	59·0	89·5	49·0	73	169
Katanning ...	30·120	30·099	30·304	29·745	76·8	47·8	62·3	91·5	35·2	72·8	48·1	96·2	33·0	2	24
Albany ...	30·112	30·126	30·385	29·705	72·3	52·3	62·3	89·0	39·0	67·6	54·0	98·8	39·6	70	193
Breaksea ...	30·140	30·106	30·383	29·693	70·0	58·0	64·0	86·0	53 0	66·4	56·2	96·4	44·0	46	179
Esperance ...	30·148	30·132	30·399	29·734	76 9	55·1	66·0	93·0	40·4	73·0	53·4	99·0	40·2	43	347
Balladonia ...	30·117	...	30·383	29·738	81·0	51·6	66·3	99·5	40·0	...	...	...	...	*Nil*	390
Eyre	30·161	...	30·420	29·846	77·4	56·1	66·8	100·8	36·7	...	...	...	...	2	310

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Observatory, Perth,
7th May, 1902.

W. E. COOKE,
Government Astronomer.

RAINFALL for March, 1902 (completed as far as possible), and for April, 1902 (principally from Telegraphic Reports).

Stations.	March.		April.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
East Kimberley:				
Wyndham ...	244	...	28	1
6-Mile	436	5	Nil	...
The Stud Station	...	...	...	...
Carlton	242	9	...	...
Denham	...	...	...	...
Rosewood Downs	417	6	...	...
Argyle Downs ...	...	...	...	...
Lisadell	96	2	...	...
Turkey Creek ...	131	6	Nil	...
Plympton, St. Mary	...	...	...	...
Kocjubrin ...	...	...	...	...
Hall's Creek ...	56	2	Nil	...
Flora Valley ...	...	...	...	...
Ruby Creek ...	...	...	...	...
Ruby Plains ...	...	...	...	...
Denison Downs ...	...	...	...	...
West Kimberley:				
Obagama ...	267	10	...	...
Derby	56	2	Nil	...
Yeeda	...	...	...	...
Liveringa ...	14	2	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs ...	...	...	...	...
Fitzroy Crossing	72	1	Nil	...
Fitzroy (C. Blythe)	80	2	...	...
Quanbun ...	...	...	...	...
Nookanbah ...	...	...	...	...
Broome	352	...	30	1
Roebuck Downs	406	6	...	...
Thangoo	369	5	Nil	...
La Grange Bay ...	138	5	Nil	...
North-West:				
Wallal	14	1	Nil	...
Condon	Nil	...	Nil	...
De Grey River ...	62	2	...	...
Port Hedland ...	Nil	...	Nil	...
Boodarie ...	...	...	...	...
Yule River ...	14	1	...	...
Warralong ...	5	1	...	...
Muccan	13	3	...	...
Ettrick	18	2	...	...
Mulgie	Nil	...	...	...
Eel Creek ...	...	...	...	...
Pilbarra	Nil	...	Nil	...
Coongon	3	1	...	...
North-West—cont.				
Warrawagine ...	...	...	...	...
Braeside	...	...	...	...
Bamboo Creek ...	15	1	Nil	...
Marble Bar ...	5	1	Nil	...
Warrawoona ...	7	1	Nil	...
Corunna Downs ...	8	1	...	...
Nullagine ...	Nil	...	Nil	...
Yandicoogina ...	Nil	...	...	...
Kerdiadary ...	Nil	...	...	...
Roy Hill	Nil	...	...	...
Mosquito Creek	...	...	...	...
Mulga Downs ...	Nil	...	...	...
Woodstock ...	...	...	...	...
Mt. Florence ...	...	...	...	...
Tambrey ...	...	...	...	...
Millstream ...	Nil	...	...	...
Yandyarra ...	Nil	...	...	...
Mallina	...	...	...	...
Whim Creek ...	18	1	Nil	...
Cooyapooya ...	Nil	...	...	...
Woodbrooke ...	31	1	...	...
Croydon	...	...	...	...
Balla Balla ...	24	2	Nil	...
Roebourne ...	Nil	...	Nil	...
Cossack	Nil	...	Nil	...
Fortescue ...	11	1	Nil	...
Mardie	Nil	...	...	...
Mt. Stewart ...	...	...	...	...
Yarraloola ...	124	2	...	...
Chinginarra ...	Nil	...	...	...
Onslow	25	1	Nil	...
Peedamullah ...	58	4	...	...
Red Hill	Nil	...	...	...
Mt. Mortimer ...	16	1	...	...
Wogoola ...	...	...	...	...
Nanutarra ...	Nil	...	...	...
Yanrey	...	...	...	...
Point Cloates ...	7	3	...	...
Gascoyne:				
Winning Pool ...	34	3	Nil	...
Towara	12	2	...	...
Ullawarra ...	...	...	...	...
Maroonah ...	...	...	...	...
Thomas Police Station	...	...	...	...

RAINFALL—*continued.*

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
Gascoyne—*contd.*				
Bangemall	...	...	...	...
Mt. Augustus	...	...	...	...
Minnie Creek	Nil	...	...	...
Yanyeareddy	Nil	...	...	...
Williambury	...	...	...	...
Wandagee	...	...	...	...
Bernier Island	...	...	...	...
Boolathana	...	...	...	...
Carnarvon	Nil	...	Nil	...
Cooralya	...	...	...	...
Doorawarrah	...	...	...	...
Mungarra	Nil	...	...	...
Clifton Downs	Nil	...	...	...
Gifford Creek	...	...	...	...
Dairy Creek	...	...	...	...
Mt. Clere	...	...	...	...
Errivilla	6	1	...	...
Dirk Hartog Island	Nil	...	...	...
Sharks Bay	Nil	...	Nil	...
Kararang	Nil	...	...	...
Meedo	Nil	...	...	...
Tamala	...	...	...	...
Wooramel	Nil	...	Nil	...
Hamelin Pool	Nil	...	Nil	...
Byro	4	2	...	...
Yarra Yarra	...	...	...	...
Berringarra	Nil	...	...	...
Mt. Gould	...	...	...	...
Moorarie	...	...	...	...
Peak Hill	3	2	Nil	...
Horseshoe	1	1	Nil	...
Abbotts	Nil	...	Nil	...
Belele	...	...	...	...
Mileura	Nil	...	...	...
Milly Milly	...	...	...	...
Manfred	Nil	...	...	...
Meelya	...	...	...	...
Woogorong	Nil	...	...	...
Boolardy	...	...	...	...
Billabalong	...	...	...	...
Wooleane	Nil	...	...	...
Murgoo	...	...	16	...
Meeka	Nil	...	...	...
Mt. Wittenoom	6	1	...	...
Nannine	Nil	...	Nil	...
Star of the East	Nil	...	Nil	...
Annean	Nil	...	Nil	...

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
Gascoyne—*contd.*				
Tuckanarra	Nil	...	Nil	...
Coodardy	...	...	...	...
Cue	Nil	...	Nil	...
Day Dawn	Nil	...	Nil	...
Lake Austin	Nil	...	Nil	...
Lennonville	1	1	Nil	...
Mt. Magnet	Nil	...	Nil	...
Warracoothara	...	...	...	...
Challa	Nil	...	Nil	...
Youeragabbie	Nil	...	35	1
Murrum	Nil	...	...	...
Yalgoo	Nil	...	3	...
Gabyon	3	1	20	1
Gullewa	Nil	...	Nil	...
South-West Division (Northern Part):				
Murchison House	Nil	...	...	...
Mt. View	Nil	...	...	...
Yuin	20	1	23	1
Northampton	7	1	Nil	...
Mt. Erin	...	...	...	...
Oakabella	...	...	...	...
Narra Tarra	...	...	...	...
Tibradden	Nil	...	...	...
Sand Springs	...	...	2	1
Mullewa	Nil	...	Nil	...
Kockatea	10	1	1	1
Bootenal	...	...	...	...
Geraldton	3	3	1	1
Greenough	Nil	...	Nil	...
Dongara	Nil	...	Nil	...
Dongara (Fearse)	Nil	...	Nil	...
Strawberry	Nil	...	...	...
Mingenew	7	1	Nil	...
Rothesay	...	...	...	...
Field's Find	9	1	...	...
Carnamah	97	2	Nil	...
Watheroo	78	2	Nil	...
Dandaragan	1	1	Nil	...
Moora	52	2	Nil	...
Yatheroo	7	3	Nil	...
Walebing	15	2	Nil	...
New Norcia	10	1	Nil	...

RAINFALL—*continued.*

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
South-Western Division, Central (Coastal):				
Gingin	Nil	...	3	2
Belvoir	7	1	2	1
Mundaring ...	Nil	...	10	2
Guildford ...	4	1	28	3
Kalbyamba ...	6	1	20	3
Canning W't'r'w'ks	Nil	...	8	2
Perth Gardens ...	7	1	19	2
Perth Observatory	8	1	22	2
Subiaco	13	1	18	3
Claremont ...	6	1	24	2
Claremont (Richardson)	...	...	...	...
Fremantle ...	1	1	30	2
Rottnest	3	1	33	...
Armadale ...	7	1	3	1
Rockingham ...	8	1	32	2
Canning River ...	9	1	2	1
Jarrahdale ...	6	1	20	2
Mandurah ...	5	1	15	2
Pinjarra	Nil	...	20	2
Harvey	7	1	16	2
South-West, Central Part (Inland):				
Hatherley ...	65	3	...	...
Momberkine ...	Nil	...	Nil	...
Culham	...	...	...	...
Newcastle ...	Nil	...	Nil	...
Eumalga ...	4	1	2	1
Northam ...	39	1	Nil	...
Grass Valley ...	...	...	...	...
Meckering ...	...	...	...	...
Cunderdin ...	Nil	...	Nil	...
Doongin	...	...	...	...
Whitehaven ...	Nil	...	...	...
Sunset Hills ...	Nil	...	Nil	...
Cobham	Nil	...	Nil	...
York	Nil	..	Nil	...
Beverley ...	Nil	...	Nil	...
Barrington ...	Nil	...	Nil	...
Sunning Hill ...	...	...	...	...
Wandering ...	Nil	...	2	1
Pingelly ...	Nil	...	5	1
Marradong ...	Nil	...	Nil	...

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
South-West—*contd.*				
Narrogin ...	Nil	...	Nil	...
Wickepin ...	2	1	...	...
South-West Division (Southern Part):				
Bunbury ...	4	1	22	3
Collie	10	3	18	3
Salvation Army Settlement	10	3	15	1
Glen Mervyn ...	19	3	22	2
Dardanup ...	7	2	16	2
Donnybrook ...	16	3	14	2
Boyanup ...	8	2	20	3
Busselton ...	8	4	43	9
Margaret River	42	2	...	...
Lower Blackwood	44	4	75	4
Karridale ...	55	7	96	15
Augusta ...	22	5	75	11
Cape Leeuwin ...	28	10	73	10
Biddellia ...	30	4	188	8
The Warren ...	89	5	...	...
Lake Muir ...	45	7	...	...
Mordalup ...	24	7	32	7
Deeside	12	3	62	7
Riverside ...	48	5	56	5
Balbarup ...	31	4	69	9
Wilgarup ...	24	4	38	9
Mandalup ...	1	1	23	2
Bridgetown ...	19	3	27	4
Greenbushes ...	53	4	58	5
Glenrichy ...	3	1	...	...
Williams ...	1	1	4	1
Arthur	5	2	6	2
Darkan	Nil	...	...	...
Wagin	5	2	2	1
Glencove ...	9	4	Nil	...
Dyliabing ...	9	4	Nil	...
Katanning ...	9	3	2	1
Kojonup ...	13	3	6	3
Broomehill ...	9	3	8	3
Sunnyside ...	6	2	4	2
Woodyarrup ...	95	3	2	2
Cranbrook ...	18	3	3	1
Blackwattle ...	30	3	...	...
Mt. Barker ...	38	4	45	7
Kendenup ...	26	4	15	3
St. Werburgh's...	49	5	...	...

RAINFALL—*continued.*

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
South-West—*contd.*				
Forest Hill ...	40	5	...	...
Denmark ...	62	4	76	7
Albany	46	4	70	11
Point King ...	57	5	88	7
Breaksea ...	44	6	46	8
Wattle Hill ...	...	...	...	...
Cape Riche ...	35	4	...	...
Pallinup ...	55	4	6	2
Bremer Bay ...	43	9	18	4
Jarramongup ...	4	1	...	...
Eastern Division:				
Lake Way ...	Nil	...	Nil	...
Mt. Sir Samuel ...	Nil	...	Nil	...
Lawlers	Nil	...	Nil	...
Leinster G.M. ...	Nil	...	Nil	...
Lake Darlôt ...	Nil	...	...	...
Diorite King ...	...	...	...	...
Sturt Meadows...	...	...	...	...
Mt. Leonora ...	Nil	...	Nil	...
Mt. Malcolm ...	Nil	...	...	...
Mt. Morgan ...	Nil	...	Nil	...
Burtville ...	...	...	...	...
Laverton ...	Nil	...	Nil	...
Murrin Murrin...	Nil	...	Nil	..
The Granites ...	Nil	...	Nil	...
Tampa	Nil	...	...	...
Kookynie ...	Nil	...	Nil	...
Niagara	Nil	...	Nil	...
Yerilla	Nil	...	Nil	...
Edjudina ...	Nil	...	...	...
Menzies	Nil	...	Nil	...
Mulline	Nil	...	Nil	...
Wangine ...	...	...	...	...
Waverley ...	Nil	...	Nil	...
Goongarrie ...	Nil	...	Nil	...
Mulwarrie ...	Nil	...	Nil	...
Kurawa	Nil	...	Nil	...
Dixie Gold Mine	Nil	...	Nil	...
Kurnalpi ...	3	2	Nil	...
Bulong	Nil	...	Nil	...
Kanowna ...	Nil	...	Nil	...
Kalgoorlie ...	Nil	...	Nil	...
Coolgardie ...	Nil	...	4	1
Burbanks P.O. ...	Nil	...	9	1

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
Eastern—*contd.*				
Burbanks Birthday Gift	Nil	...	2	1
Woolubar ...	...	...	...	...
Widgiemooltha...	5	1	1	1
50-Mile Tank ...	Nil	...	20	1
Norseman ...	6	1	22	1
Bulla Bulling ...	21	2	5	1
Woolgangie ...	...	...	Nil	...
Boorabbin ...	Nil	...	Nil	...
Karalee	12	2	...	...
Yellowdine ...	5	1	...	...
Southern Cross...	33	2	Nil	...
Mt. Jackson ...	Nil	...	Nil	...
Bodallin ...	9	1	Nil	...
Burracoppin ...	Nil	...	Nil	...
Kellerberrin ...	10	1	Nil	...
Mangowine ...	10	1	Nil	...
Wattoning ...	...	...	...	...
Eucla Division:				
Ravensthorpe ...	36	7	15	7
Coconarup ...	45	7	...	...
Hopetoun ...	49	8	18	5
Fanny's Cove ...	9	2	...	...
Park Farm ...	23	4	...	...
Esperance ...	16	...	43	3
Gibson's Soak ...	10	1	...	...
30-Mile Condenser	17	3	...	...
Swan Lagoon ...	8	4	...	...
Grass Patch ...	14	5	...	...
Myrup	33	3	...	...
Lynburn ...	16	2	...	...
Boyatup... ...	23	4	...	...
Middle Island ...	...	...	...	...
Point Malcolm ...	10	1	...	...
Israelite Bay ...	4	1	Nil	...
Bulbinia ...	...	...	...	...
Frazer Range ...	2	1	...	...
Balladonia ...	4	2	Nil	...
Southern Hills ...	10	1	...	...
Eyre	30	4	2	2
Madura	...	...	...	...
Mundrabillia ...	21	1	...	...
Eucla	36	2	38	5

The Observatory, Perth,
May 7, 1902.

W. E. COOKE,
Government Astronomer.

Return of Fruit imported into Western Australia during April, 1902.

Name of Port.	No. of Consignments Inspected.	Total No. of Cases.	No. of Cases Passed.	No. of Cases Prohibited.	No. of Cases Destroyed.	No. of Cases of														
						Apples.	Apricots.	Bananas.	Cherries.	Gooseberries.	Lemons.	Peaches.	Oranges.	Passion Fruit.	Pears.	Plums.	Rhubarb.	Pomoloes.	Pines.	All other fruits.
Fremantle ...	...	4845	4385	460	450	870	...	917	...	25	627	...	1113	...	224	572	...	...	11	26
Albany	...	175	169	6	6	53	...	28	...	...	4	4	...	...	12	27	31	...	...	10
Geraldton ...	...	2	2	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	...	5022	4556	466	456	923	...	947	...	25	631	4	1113	...	236	599	31	...	11	36

Department of Agriculture,
8th May, 1902.

Return of Fruit Trees and Plants imported into Western Australia during April, 1902.

Name of Port.	No. of Consignments of Trees or Plants.	Total No. of Trees or Plants in such Consignments.	No. of Consignments passed.	Total No. of Trees or Plants in such Consignments.	No. of Consignments of Trees or Plants prohibited.	Total No. of Trees or Plants in such Consignments.	No. of Packages dipped.	No. of Trees.															
								Ornamental and Pot Plants.	Almonds.	Apples.	Apricots.	Cherries.	Figs.	Lemons.	Limes.	Mulberries.	Oranges.	Peaches.	Pears.	Plums.	Small Fruits.	Vine Cuttings.	All other Trees.
Fremantle ...	5	1586	5	1586	...	...	...	1586	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Albany ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Geraldton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	5	1586	5	1586	...	...	...	1586	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Department of Agriculture,
8th May, 1902.

By Authority: Wm. Alfred Watson, Government Printer, Perth.

JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA.

Vol. 5.—Part 6.

JUNE, 1902.

PERTH:
BY AUTHORITY: WM. ALFRED WATSON, GOVERNMENT PRINTER.

1902.

NOTES.

TECHNICAL EDUCATION.—On Saturday, 30th May, the students of the Agricultural Class at the Technical School (accompanied by their instructor, Mr. Percy G. Wicken, Mr. Despeissis, and several of the officers of the Agricultural Department) paid a visit of inspection to the manure works of Messrs. Couche, Calder, & Co., at Welshpool. The visitors were met at the works by the manager (Mr. R. Binney), and were conducted over the works. The process of steaming, grinding, and mixing the bonedust was fully explained from the time the bones are received until placed in the trucks consigned to farmers in the country districts. The method of handling other manures was also explained by the manager. An instructive afternoon was spent at the works, and, after a hearty vote of thanks to the manager, the party returned to Perth well pleased with their afternoon's outing.

FERTILISERS THAT AFFECT SEED GERMINATION.—The Department of Agriculture of U.S. of America has had many inquiries concerning the effect of commercial fertilisers on garden and farm seeds. A number of tests were inaugurated, and as a result it was shown that in many cases, if not in most, the application of fertilisers directly in the row at planting time is detrimental. It seems that the injury is caused by affecting the sprout after it has passed through the seed coat. Muriate of potash and nitrate of soda in strengths of 1 per cent. or more are very detrimental to the germination of the seed, whether applied directly or mixed with the soil used as a covering. Fertilisers composed of phosphoric acid or lime are much less injurious than the above, and, if not used in excess, may prove harmless. Commercial fertilisers should not be brought into direct contact with the seed in any event. In these tests the fertilisers were mixed with the seed or the soil in which the seed was planted. It is highly improbable that any of them, if applied in the usual way on top of the ground, actually favour germination.—*American Agriculturist.*

FEEDING THE SITTING HEN.—A sitting hen should only be fed once a day. If her appetite is decent, she should get hard grain only, and for preference maize. The latter keeps up the heat of her body much better than any other kind of grain, although a feed of barley may be given twice a week as a change. If she will eat little or nothing, then she must be tempted with soft food. A little oatmeal, with some barley-meal, is best, and as soon as she will take to hard grain it is better that this alone should be supplied. Green food should not be given, as this has a tendency to relax the bowels, which is undesirable. Sharp grit should be in a box at hand, although sitting hens seem to pay little attention to it, and a supply of pure water should also be given. It is better to

give them their corn first, however, as they are likely to drink so much water that they will eat very little afterwards. A dust bath should always be waiting them after they come off the nest. This is most necessary for their comfort, and should never be omitted.

THE REAL RUBBER TREE.—The so-called rubber tree, with its thick, glossy, green leaves, common in hot-houses and gardens, is that which produces the gutta percha. It is little like the great tree from which comes the best rubber of commerce. The real rubber tree is not unlike other forest trees, resembling the English ash, and growing to a height of more than sixty feet. Its bark is silver grey, where it has not become black from being tapped. Its trunk is about as big as a man's waist. Where it has been tapped it often swells out at the base, so that it is much larger. It blossoms in August, being then covered with little white flowers. It bears nuts, and in December and January, when they are ripe, the shells burst with a noise like a fire-cracker, throwing the nuts some distance. There are so many nuts on each tree that a man could easily gather enough in a day to plant a hundred acres of land. The trees can be easily grown in the right soil, and they thrive without cultivation; but to yield rubber they must be 15 years old. Fifteen years is too long a time for a man to wait in Australia, and at present the trees which produce rubber are wild.

FOALING SEASON.—When the foaling season comes, and the working horse strength is weakened through the brood mares being otherwise engaged, their places should be filled up with young animals. The two-year-olds which have not looked through the collar should be taken in hand and put gently to work, and if they are numerous enough to give them half a day each, so that two take the place of one horse, so much the better for the colt and its owner. If there is no ploughing to be done, they can be put to scuffle or drag on the root land, and on a grass farm the operation of breaking need not be neglected. The colt or filly may be attached to a log of wood—of course with a rein and man to lead on either side—for a start, then to chain-harrows, which can hardly be used too much on pastures, and in this way be got tractable enough to pull its portion when required in the room of the mare which is nursing a foal to grow on and take its place in the team in due time.

AN IN-BRED HERD.—An instance of long-continued in-breeding in cattle is mentioned in a late number of the *Live Stock Journal*. The herd was established in the year 1843, at the Hollies, a small holding situated close to the foot of the fells in the vale of Lorton, Cumberland. In the year named Mr. J. Banks, then tenant of the farm, not being content with the quality of his cattle, sold three of his cows, and with the proceeds of the sale set off in quest of fresh blood. He travelled on foot to Lowther Castle, near

Penrith, and from there went to Mr. Unthank, at Netherscales, where he purchased a cow called Red Rose for 40 guineas, and drove her home to the Hollies, about 30 miles, over some of the wildest parts of that rugged country. The account of the herd in the journal mentioned states:—"From that cow alone a herd of really splendid cattle have been bred, and what is the most remarkable feature in the history of this herd is the fact that since a few years after the purchase of Red Rose no out-cross has been introduced; cows and bulls, all direct descendants of this one cow, have been mated, and have bred till now cattle of a stamp difficult to beat in any herd. Wide-chested, deep and level carcase, evenly fleshed, with a profusion of hair, and heads of a beautiful shorthorn type were the qualities which made these cattle so much admired." The character of the old farmer, as shown in his sturdy independence in walking over the country in search of the animal he wanted, the remarkable judgment he displayed in making his selection, and then driving his purchase home, are admirable, and quite different from the mode of proceeding that would be adopted by a farmer of the present day. This herd was dispersed on February 18, when the stock made excellent prices.

English Dairy Imports.—The English dairy imports for 1901 were 7,251,777cwt., comprising 3,702,810cwt. of butter, 962,082cwt. of margarine, and 2,586,885cwt. cheese, of a total value of £28,080,964. The supplies are derived from Denmark, Australasia, Russia, France, Holland, Canada, Sweden, the United States, Germany, and several other countries. Denmark sends more butter than any other country, her total in 1901 being no less than 1,597,185cwt. Australasia of late years comes next, in 1901 with 413,134cwt., which, it will be seen, is far below the quantity sent from Denmark. Curiously enough, Russia comes next with France fourth; while Canada in 1901 sent only 215,588cwt. In round numbers, Denmark sent 43 per cent. of the whole, Australasia 11 per cent., Russia 10 per cent., France 8 per cent., and Canada 5 per cent. It is evident that there is a wide field for the outlying parts of the Empire, which, in some cases at all events, they seem very well disposed and able to occupy.

Supply Salt to the Sheep.—To keep the sheep in a healthy condition it is necessary that they be supplied with a sufficient amount of saline matter. When this is wanting in the pasture, as it frequently is, except near the sea coast, it must be supplied artificially. Salt is more or less poisonous to worms and flukes, hence it is necessary to give sheep a plentiful supply. The effect of the lack of salt is to cause debility in the sheep, so that they cannot resist the attacks of the parasites, and these always thrive in a weak animal. Salt alone is not sufficient in inferior pastures; sulphate of iron (copperas) should also be given in the salt, which acts as a tonic, and is good for intestinal worms. Of the copperas, fully powdered, put one pound to 10 of salt, and protect the mixture from the rain.

THE INSECTIVOROUS BIRDS OF WESTERN AUSTRALIA.

By Robert Hall.

PART III.

BIRDS: INSECTIVOROUS AND GRANIVOROUS.

[BENEFICIAL.]

The present part is intended to attract attention to such birds as quails, which are grain-eating as well as being insectivorous. They admirably serve the interests of the agriculturist by eating, in addition, many kinds of lowly organised animals. Such birds as the Pipit, Song-lark, and Whiteface, though eligible for this section, play so important a part in the economy of the field that they have been placed in the leading head. Possibly it may be thought the Magpie should here be represented, but it appears to me to be so genuinely insectivorous in this State that it has been placed in the first part. Only when intense culture of a large portion of a country, and the reduction of its natural feeding grounds are effected, does the Magpie resort to habits of doubtful good. The Mallee Fowl, because of its unique position in the avifauna, and its approaching time of extinction, is worthy of special notice. Interesting and instructive reading should be found in a further record of its habits, which are so materially different from those of all other birds, beyond "Mound Builders," of which it is one species.

Mallee Fowl.

(Ngou: Native Pheasant.)

Lipoa ocellata, Gld.; (Li-po'a os-el-a'ta).

Lipein, to leave; *ocellata*, little eyes.

Leipoa ocellata, Gould, "Birds of Australia," fol., vol. v., pl. 78. "Key to Birds of Australia," Hall, p. 74 (1899).

Geographical Distribution.—Areas, 9, 7, 6.

Key to the Species.—General appearance, black and grey; under surface partly scaled; top of head covered with feathers, forming a short, thick crest; nostrils elongated and oval; tail long, rounded with 16 feathers; the long upper tail coverts reach to the end of the tail; a double row of large hexagonal plates down the front of the rather short tarsus.

The most unique bird, and one that is peculiar to Australia, is undoubtedly the present form. It is a representative of the Mound-builders. Of the four species, two are to be found in our State, one ranging across the whole Northern portion of the continent, the second along the Southern parts. This latter species is not to be found either at the extreme South-West or South-East, because the timber is too moist. The bird frequents only the dry stunted timber of waterless tracts. Although to a large extent insectivorous, it is not strictly so. It certainly is quite harmless.

Apart from the nature of food, to shoot the bird is bordering on a crime because it has greatly helped to make Australia zoologically famous. Study its life history and where do we find a parallel one? Like certain of the Reptilia, it arranges for artificial heat to incubate the eggs in a mound of sand and decomposing leaves.

Such a hillock I measured and photographed, and found it to have a circumference of 48 feet.

A good general history of the bird has been given in the *Ibis*, 1899, by Mr. W. H. D. Le Souëf, C.M.Z.S. The author well remarks:—"The bird has an extensive range in the Southern half of Australia. It is, practically speaking, found wherever the mallee (a dwarf eucalyptus) grows, and hence the name of the bird, as it is always associated with the mallee or similar scrub. The country where this tree grows is mostly sandy, with a small rainfall, and is often being intersected with sandy ridges, popularly called pine-ridges.

"The male and female birds differ very little in markings, and their mottled black and grey colour harmonizes wonderfully with their surroundings. As they are shy and solitary, they are rarely seen, but specimens are sometimes obtained by patient watching near their nesting-mound. They occasionally utter a low, soft note, and their gait, when undisturbed, is a slow walk. They can run fast if necessary. Their food consists of insects, berries, and the buds of a small shrub. They go to roost in trees when it is almost dark.

"The nesting-mound of these birds is generally situated close to some pine trees, or with thick scrub near or round it, and rarely without cover being near. When the scrub has been cut down round their old nesting-place they leave it and form another, but they prefer to make up their old mounds if possible, and the same places are often used year after year. When the birds have selected a site, they scrape out a slight hollow in the ground, from six to eight inches deep in the centre and about two feet wide. Next they scrape up leaves, bits of bark, twigs, and other vegetation that may be lying about, and put enough on, not only to fill the depression, but to make a small mound of it, about eight inches or more above the level of the surrounding ground. They then form a hollow in the centre of the vegetation about one foot wide and six inches or more deep, this being the egg chamber; after which they scrape sand all round the nest and leave it until rain comes and well wets the vegetation. The sand is then spread well over the mound to a depth of about six inches; and after a few days, when the vegetation has heated, the mound is ready for eggs. The nest is generally made in July or August, and the first eggs are laid towards the end of September, but the absence of the necessary rain sometimes makes it later. Both birds assist in making the mound. The sand is scraped together with both the feet and the wings, the latter being used especially when getting the sand well up on the mound, which, when finished, often measures at the base twelve feet in diameter, and in the centre from two to four feet

high, and as the sand is generally dry, and runs freely, it is no easy matter for the birds to heap it up as they do. The various measurements given are about the average, as they differ more or less in every mound. The nest being ready for eggs, the hen bird scrapes out most of the sand from the egg-cavity, and leaving about two inches of it at the bottom, she then lays her egg, and holding it upright with one foot, with the small end downwards, she scrapes the sand round it with the other foot until it can stand alone. The bird has to lean well back to enable her to use both her feet. She then covers the whole with sand. The egg-cavity has to be scraped out and refilled every time an egg is laid, giving much work to the parent birds. The eggs are generally placed at the outer edge of the chamber, and one often in the centre. The first eggs are covered up with about two inches of sand over them, and a second tier commenced; each egg being laid opposite the interspaces of the lower lot. There are generally three tiers, with from three to five eggs in each, and a full clutch is about fourteen. I have always found the temperature of the egg-cavity to be from 95° to 96° Fahr. The eggs are laid at daybreak on every third day, and incubation takes a little over five weeks. As incubation starts as soon as the egg is laid, the young ones are ready to hatch at different times. The eggs are usually of a delicate pink colour, especially when first laid, but the pink colouring matter easily comes off, especially after the egg has been taken out of the nest for some little time, and leaves the white under surface exposed; occasionally I have found all the eggs in one mound pure white. The shell is very fragile, and one reason why the eggs are placed on end is evidently to sustain the weight of sand with which they are covered; the sand round the eggs is generally slightly damp. Sometimes when the parent bird is opening up the mound, she scratches a hole in the top of one of the eggs; the sand then gets in, and mixing with the contents, forms, when dry, a compact sandy mass, completely filling the shell. On one occasion I found five such eggs in one mound.

There has been much discussion as to whether the young birds can make their own way out of the soil unaided by their parents. In order to settle it, I covered with wire netting a nest with several eggs in it, so that the parents could not open it up, and found all the chickens, when they came to maturity dead in their shells. Then again, on taking the eggs from a nest you often find chickens in their eggs which are ready to hatch, especially in the lower tier; so much so, that, when opening the egg, you have to hold the young bird firmly to prevent it escaping and running away. Then on other occasions, you find chickens near the surface under the sand, apparently working their way out unaided. The old birds open up the nest to a certain extent daily at daybreak, and it is probable that any chickens that may be ready to come out, especially in the lower tiers, do so then. Moving the sand also prevents it from becoming set. But the chickens that hatch from the eggs of the top tier, the sand there not being set so tightly, and being drier and running more freely, are able to force their own

way out, and judging from the experiments I have made, I should say this was usually the case. On opening up the nest that had been wired in, I found that the sand had set rather tight, especially where the eggs were, and this I should say fully accounted for the young birds being unable to come out. When the mound is opened up during the day and eggs abstracted, the birds repair the mound shortly after the intruder has gone away, showing that either one or other of the birds generally remains in the neighbourhood.

MALLEE FOWL—Nest.

"When the young are hatched, they are well able to take care of themselves, being strong and well developed, and their wing feathers sufficiently formed to enable them to fly a short distance; but they trust almost entirely to their running and hiding to escape danger, and to catch a newly-hatched young one in the scrub is no easy matter. The parent birds seem to take very little notice of their young, which lead an independent existence from their birth."

Because of the peculiar habit the adults have of leaving the nest, the generic name Lipoa has been applied.

The "little eyes" most likely refers to the plumage marks, though they are not very definite.

The judgment of my companion, Mr. Arthur B. Lord, in making an exact photographic exposure while I arranged other matters, has produced an excellent picture of the nest.

Nest.—A large mass of sand and leaves, with a diameter of 13 feet, and a height of 3 feet, approximately.

Eggs.—Six to 15 in a mound; colour, delicate pink to brick-red; length, 3·5 inches; breadth, 2·25 inches.

NOTES ON THE UPPER PRESTON AND DISTRICT.

By A. Vaughan.

This is one of the heavily timbered districts, with a good rainfall and moderate climate, which will take time before it produces all nature intends it should, on account of the initial expense of clearing and bringing into cultivation.

In its natural state this country may not be so valuable, as far as stock and wheat growing is concerned, as some of the drier districts, but its possibilities are great, and it is eminently suited for close settlement.

Fruit Growing.

One of the chief products must be fruit. All pit and most of the stone fruits flourish and produce fruit of first-class quality. The trees grow in a variety of soils as long as it is well drained: this is a point that should be well studied. Cherries and apricots have been more or less failures, and we cannot advise planting these two varieties of trees until they have been proved.

Mr. Hackett's Orchard.

A nice young orchard coming on, of about 20 acres, planted with apples, pears, and stone fruit. Mr. Gates, the manager, also goes in for market gardening, and has been very successful in growing rhubarb, being one of the first to try and grow it on any extensive scale; it is grown on a moist flat in a deep friable loam.

Mr. Walters' Orchard.

About 10 miles from Donnybrook, on the banks of the Preston, is another property that does credit to the owner. Thirty acres is planted with apples and pears, mostly apples, and two acres each of stone fruits and grapes. This is an old property, and where the orchard is now at one time was covered with couch. Mr. Walters has had a great battle with it, but is certainly gaining a victory. The growth of the trees would be hard to beat anywhere, and they certainly have benefited by the extra cultivation which has had to be given on account of the couch. When the new orchard was first planted, there were a few old apple trees which, through bearing fruit (and fruit was worth a shilling a pound in those days) were infested with woolly aphis. These were promptly grubbed up and burnt. Mr. Walters determined to start clean, and issued an ultimatum against both fungoid and insect pest, which he is acting up to.

M. Thompson, Brookhampton.

This is one of the oldest properties situated on Thompson's Brook, about five miles from Donnybrook, and shows what the country can do in producing stock. The amount of stock that can be reared and fattened off some of Mr. Thompson's flats, laid down with rye and couch grass, only shows that when once the timber is killed, and the country is broken up and sown with grasses, the carrying capacity will be increased tenfold. Mr. Thompson complains of a noxious weed that at certain times of the year spoils all his butter, and he has not been able to find a remedy or altogether identify the weed: this matter would be well worth looking into. This is not the first complaint I have heard, and some farmers have become so discouraged, that they have stopped butter making, which is a pity, as dairying ought to be one of the industries of these parts.

May, 19, 1902.

PLANTING.

A. Despeissis.

Before planting a vineyard or an orchard, the question should have been fully discussed what special market it is intended to supply. Whether it is intended to dispose of the fruit locally or to ship it; to manufacture the grapes into wine or brandy; to turn them into raisins, or to sell them fresh as table grapes.

The natural circumstances of soil, climate, and orientations should also influence the selection of the varities it is intended to grow. Favour the quick ripening of early sorts by planting on well exposed slopes. Again, in the case of fruit trees and vines, study the likings of each sort; putting the yellow Bellflower apple on the lighter patches of soil, in preference to the Newtown pippin, which prefers a stronger soil. Some varieties again show greater predisposition to diseases in low moist locations, and should for that reason be planted on well drained slopes; the Cleopatra apple, which is somewhat subject to the "bitter pit" disease, is a case in point. Other questions as well require consideration when planting, for instance, such self sterile fruit as the Bartlett and other pears. Top graft a few of these or plant amongst them some varieties which will supply the pollen necessary for insuring cross fertilisation and the better setting of fruit. Pears and plums do better on a strong retentive soil than peaches and nectarines. Cherries do better on stony land on a high slope. Walnuts and chestnuts in well sheltered, shaded and moist situations. Almonds and figs in the warmest and driest parts. Oranges in rich, warm, and well-sheltered places. With reference to grape vines due attention should be paid in those places periodically visited by late frosts to the time the several varieties burst into leaf. Amongst those varieties budding late are: Carignane, Mataro, Cabernet Sauvignon. Amongst those pushing forth their buds early the Chasselas, Malbec, Grenache, Verdot, Pinot, Muscat, Black Hamburgh.

In close proximity to a large market, and where easy means of communication exist, summer and early autumn fruits that are not suitable for distant transportation and require to be consumed as soon as ripe would be profitable; there also early sorts will pay better than late varieties that could perhaps be grown to greater perfection in some more remote district.

On the other hand, the more distant grower will find autumn and winter apples, pears, and fruits that carry well more profitable.

Only those varieties that have been well proved as suitable in regard to soil, climate, or the special purpose they are grown for, should be cultivated, and of these, the varieties that succeed remarkably well in a particular locality more largely planted.

Having made up your mind what sort of produce you want to turn out, and satisfied yourself as to which varieties succeed best in

the particular locality you are in, plant as few varieties as possible. You will find a readier market for your produce if you only keep a few "lines," to use a term employed in commercial circles. Do not have all the sorts ripening at the same time; in an early district favour more especially early sorts, and in a late one, late varieties of fruit, as you will then, with your produce meet a firm market that is not glutted with fruits of all sorts.

Vine-planting.

Some vines, such as the Malbec, for instance, are much liable to the accident of *coulure*, or of imperfect setting of the flowers, when grown on low ground with bad drainage, and do far better on deep, free, undulating ground. Table grapes should be planted in the richest soil in the vineyard, more especially if they can receive a few extra waterings from the time of flowering till the period the berries change colour.

Whatever kind of grapes are planted, let each variety stand separately. I have seen on some of the most famous and ancient vineyards of the Medoc near Bordeaux, the Cabernet, the Malbec, the Merlot, and the Verdot planted indiscriminately in the same field, but that practice has gone out of favour now; and although it is advisable to blend the grapes in the fermenting vats together, so as to insure their several constituents getting incorporated thoroughly with each other during the process of fermentation, this blending can be just as easily made in the suitable proportions without the different varieties of vines being grown indiscriminately together.

The advantages of keeping the varieties separate may thus be summed up:—

1. The vines look more uniform in the field, and a more delicate and perhaps superior variety of vine is not thus exposed to be dwarfed or choked in its growth by more common and more rustic vines.
2. Varieties more liable to specific fungoid or other pests can receive special attention, and the disease be thus warded off or kept down.
3. Each variety can be trained, pruned, or summer topped, according to the method best suited to its particular habit of growth.
4. The picking can be done in succession by taking the varieties as they come to maturity in their proper order.

The best way of stocking a vineyard is by using *cuttings* wherever the spring and summer months are moist enough, or *rooted* plants when there is a risk of a long spell of dry weather. Seedlings are never raised for extensive planting, as they do not bear a crop until the fifth or sixth year at least, and besides, like most other intensely cultivated plants, vines grown from seeds always show a tendency to sport and generate new varieties.

The best cuttings are obtained from the middle portion of the bearing canes of the previous season, the wood being well summered, keeping for a long time, and striking root and budding readily. The shorter the cutting the stronger the vine.

Very tender cuttings are those that grow quickest: but they are also very apt to soon get dry, on account of the pithy condition of the wood, and are not to be relied on in dry seasons and open-air cultivation on a large scale. It often happens that the plants they grow are, besides, of a weak constitution. On the other hand, cuttings with hard and tough wood do not strike root so easily, and show a tendency to grow more wood than fruit. Whenever, therefore, it is possible, the middle part of a cane, of well constituted summered wood, should be chosen from prolific plants.

Cuttings 10 inches to 14 inches long are the best for planting in this country, and only one of the buds should show above ground and not two or three as are often left. The complete covering of the cutting and of the terminal bud under some sand or loose soil, delays the growth of the leaves, which are the essential organs of evaporation of the plant, whilst the young roots gradually take hold of the ground and supply food for the requirements of the young vine. If more than one bud be too much exposed to the air and light, too many leaves might grow, and as the evaporation through these organs is excessive, compared with the amount of moisture the tender rootlets can absorb, the young plant, after having shown a fictitious growth for a while, soon withers and gradually dies away.

The joints should be short and numerous, and no cuttings should be taken from a vine attacked by any fungoid pest, such as *anthracnose* or *oïdium*, &c., as they are as a rule less vigorous, and there is always the risk of propagating the disease and infecting the young vineyard with the disease.

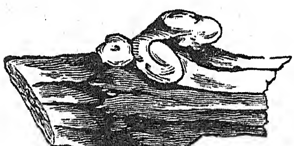
These details having been attended to, cuttings will be obtained that will strike more readily and produce stocks that will soon bear a heavy crop of fruits. The fresher cut, the better will cuttings strike. It is not always possible though to get cuttings freshly pruned, as late pruning delays the bursting of the buds in the spring, and causes the vine to weep, thus weakening it, whilst it may happen that cuttings may have to be got from great distances.

A good packing for vine cuttings, when sending them a long distance, is to tie them into bundles of 100 to 200 each, and put around them some straw very slightly moistened with water, and wrapped up in more dry straw and then put in cradle cases or in gunny bags, which, on arrival, should be opened, the bundles taken out and placed in an open furrow in some place of the vineyard not liable to be flooded and where the soil is loose and well drained.

The best time for planting is at the beginning of the spring, in the moister districts, as at that time the surface soil has been

sufficiently penetrated by the warmth of the atmosphere to favour the growth of the tender rootlets. In drier places, where the hot weather comes early and the rainfall gets scarce as the spring draws on, the planting should be done a little earlier.

The importance of only planting such cuttings as are likely to strike is evident, as if many blanks have to be filled in the season after, it is always at greater expense, and at a loss of twelve months, so far as the bearing of the vines is concerned. Should any doubt be entertained as to the striking capabilities of the cuttings—and some varities, such as the brown Muscat, for instance, are very hard to strike--the bundles are often taken from the trench where they have been lying, and placed a few inches deep into water. After three or four days, the bark gets sappy, and small wart-like swellings, covered with a little gummy substance, show at the butt. The cuttings should then be planted without delay, as the rootlets of the plant, looking like delicate white little threads, soon break out and might possibly be damaged during the operation of planting.



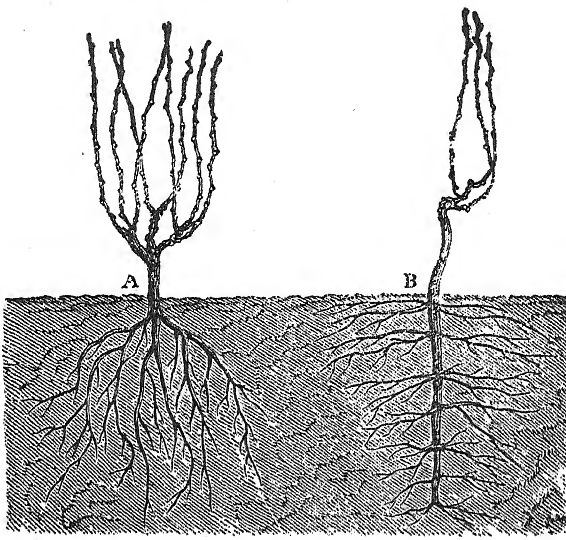
Single Eye Cuttings.

A single eye cutting produces a more vigorous root system than a cutting 10 to 12 inches long, and a medium size one will, in a similar manner, strike a better constituted root system than long cuttings 18 to 20 inches long, in which case a distinct system of roots will come out in layers out of every joint, and will not be so strong and vigorous as if they issued from the same joint as near the surface as possible, and with a tendency of striking deeply into the soil, in a downward direction.

In order to insure a good proportion of these single eyes striking, they are set in the spring, in moist sand under glass frames, and when the shoots commence to push upwards, fed by the tender

roots in the sand, they are gradually hardened by more direct exposure to the air and are finally transplanted, when they make sturdy plants.

It is often necessary to keep the vine-cuttings a month or two before they can be planted out; they should in that case be put temporarily in a trench dug in well drained and moist soil and banked up with earth where they will keep dormant; at planting time, only a sufficient number of cuttings for the day's requirements should be taken out.



A. Strong vine from short cutting, showing vigorous root system, growing from the same joint. B. Weaker vine from long cutting showing disposition of roots.—(*Foex.*)

Rooted vines, whenever obtainable at a reasonable price, are much more certain to strike root and grow, and although in many parts of the Eastern States, where the spring and summer months are moist, cuttings are generally planted in preference, yet in this State they will be found to give better results and reduce to a very considerable extent the percentage of misses. On the one hand the cost of rooted plants is five or six times as much as that of cuttings, but, as a compensation for the heavier outlay, the certainty and the more uniform growth and early cropping are in favour of rooted vines as compared with cuttings.

A small nursery should be planted to provide rooted vines for filling up blanks occurring after the first season's planting. Few cuttings, probably, strike better than vine-cuttings and those can be got at pruning time for little over the cost of trimming.

For stocking a nursery, shorter cuttings than those generally used for planting out in the open field are preferable, as they

develop a better root system, and are less liable to dry up and perish, as more care and attention can be given them, and the desirable amount of moisture in the ground can be better maintained by means of more thorough cultivation or by occasional waterings, mulchings, etc.

In the nursery the cuttings can be put in at a distance of 6 to 10 inches, with an interval of 18 to 24 inches between the rows. The plants should be lifted up with much care so as to injure the tender roots as little as possible, and these should be carried to the field either wrapped up in a wet bag and put in a basket or placed in a bucket of water.

The holes having been previously dug, the bruised roots are trimmed with a sharp knife or a secateur, and the rooted vines planted in the way fruit trees are generally planted; all shoots but one are then cut off, and on this two good buds alone are left.

Unlike cuttings which are planted very early in the spring, rooted vines may be put in the ground at any time in the winter; they then establish themselves and take a good hold in the ground, and make a vigorous growth as soon as the spring sets in.

Sandy loams do not show a tendency to crack in dry and hot weather; but in heavy soils the ground, by contracting in the summer, very often leaves an open space round the cutting, especially if it has been put in vertically, without having been slightly bent. In that case, and unless some sand can conveniently be put round the cutting, the hole should be well trampled down, up to about two-thirds of the length of the cutting or rooted plant, and the remaining third banked up with the more friable and well-pulverised soil, which is left loose on the surface.

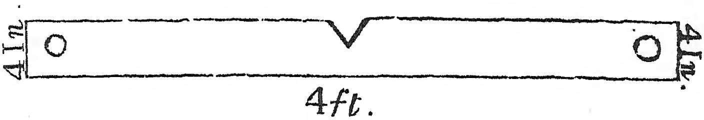
A handful of bone-dust or some other phosphatic manure and wood ashes, kainit, or better still either sulphate or muriate of potash, worked with the earth round the plant will in many places provide nutriment for the young rootlets, and insure the rapid growth of the vine or fruit tree as the case may be.

Tree Planting.

The ground should be marked off, so that whichever way the rows are looked at they all seem to be in perfectly straight lines; then the holes are dug.

The holes for fruit trees should be wide enough to permit of the spreading of the roots; the wider the better. In heavy, retentive soil they should not be deeper than the land has been ploughed, as otherwise such holes would get full of stagnant water, and would hold it like a basin; many a fruit tree has been killed through the roots thus decaying instead of growing in a healthy condition.

Before the holes are dug and in order to insure that the trees will occupy the exact spot the stakes were in, a simple contrivance known as the "tree-setter" is of great use.



It consists of a light piece of board 1 inch thick, 4 inches wide, and 4 to 5 feet long. Cut a V shape notch in the centre and either bore a hole $1\frac{1}{2}$ inch in diameter at 3 inches from each end; or, instead of the holes, cut notches at each end of the board.

To use the "tree-setter," the V shaped notch is put against the stake, which marks the spot the tree is to occupy. Through the hole at each end, or in the notches, as the case may be, drive into the ground pegs 1 to $1\frac{1}{4}$ inch in diameter and 12 to 15 inches long that will easily pass through the holes. This having been done, remove the central stake in the V notch, lift the board over the two terminal pegs, which are left in the ground, and dig the hole. When planting, replace the "tree-setter" over these two pegs, and place the stem so that it will fit into the V; it will then occupy exactly the same spot the stake occupied when the ground was laid out.

The hole should be three feet square, convex in the centre, or of the shape of an inverted saucer. This is done by heaping up some loose surface soil, so that when the tree is planted its base stands a little higher than the roots, which spread out evenly round, radiating outwards with a slight dip downwards.

Wherever patches of hard ironstone conglomerate, such as are met with at places on the Darling Range, or of impervious peaty or calcareous hardpan, such as exist sometimes round ti-tree swamps in the coastal zone, occur, a cheap and convenient method of getting rid of them will be by shattering them by means of cartridges of dynamite, or else by $1\frac{1}{2}$ lb. charges of black blasting powder rammed into holes two inches in diameter bored through the hard pan. By this means numerous crevices will be formed which will promote the drainage of the land and permit the roots of the plants penetrating through the pan and gaining access to the subsoil underneath.

Selecting the trees from the nursery requires some discrimination. The varieties to be planted having been decided upon, place the order with a good and reliable nurseryman, preferably a local one with a reputation to keep up. Sixpence more on the price of a tree, when compared with the fruit peddler's quotations, may have to be paid, but it will be money well invested. I am every season receiving for identification fruit from trees ordered from bogus nurseries, or from "cheap" trees sold by auction, which often are

N.B.—The figures indicating the number of trees to the acre given in the chapter on the laying out of the ground, are correct in so far as one single acre is concerned; for a larger number of adjoining acres, a small deduction should be made.

not what they were represented to be. These are mostly the unsold stock of nurseries, and are often sickly, and may not be true to name.

When buying trees it is well to stipulate that the stems should be smooth, the roots not too much hacked about; that the trees, if peaches, should be on peach stock, except when planted on heavy clay or in damp places, when they might be on plums; apples on northern spy, citrus trees on bitter orange, or on pomelo, to guard against collar rot. It is well to require some guarantee that the trees are free from fungi and injurious insects, and more particularly some of the worst scale insects.

On arrival, each tree should be carefully examined for any indication of root galls, scale insects, black aphis, borers, or fungoid disease, and unless it is accompanied with a certificate of disinfection at the nursery, it should be treated by dipping in warm whale-oil soap suds (1lb. of whale-oil to 3 gallons of water), or in kerosene emulsion for a couple of minutes in the case of insect pests, or in Bordeaux mixture in the case of fungoid disease.

They are then heeled in without delay. For that purpose a trench is dug in moist but well-drained soil and the trees placed in it, slanting towards the same direction, and loose, well-pulverised earth banked up round the roots and every part of the stems; the trees will stand in that state until required for planting.

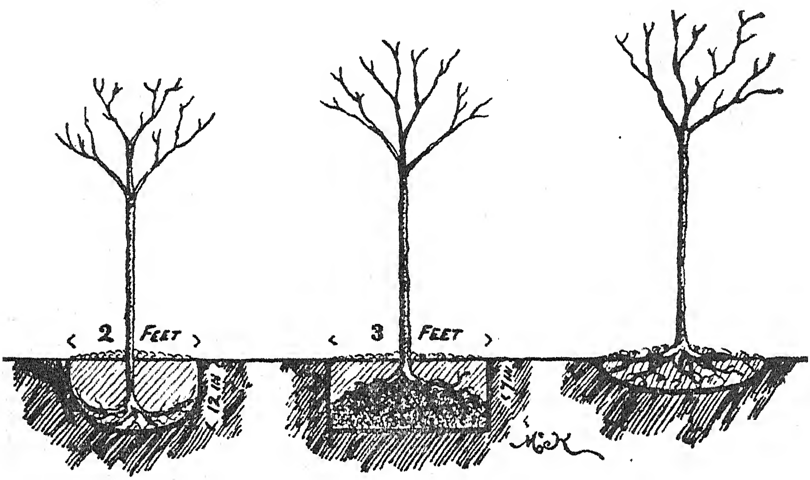
It happens that they are sometimes barkbound, showing a leathery, shrivelled bark. In that case they should be thoroughly-drenched first and then stratified or covered up with moist loose earth or sand, root, stem and branches for a couple of days or so, when, unless too far gone they assume their healthy look again.

The best time for planting all sorts of trees is when the sap is down, and after the autumn and winter rains have penetrated the soil to a good depth. That time in this State will be from May till August. Citrus trees are best set out after the first autumn rain or, better still, late in the winter in August. Do not plant while the earth is water-logged, as its handling at that time would puddle it, and it would cake round the roots of the tree and subsequently crack and let in the hot air that might parch up the tender roots.

On taking the trees from the trench, make, with a sharp pruning knife a clean cut of any bruised root, and taking the tree to the hole dug on the spot it is going to occupy, with a few shovelsful of earth raise the bottom of the hole so that the collar or ground line on the stem is flush with the surface ground of the orchard. The tendency until a few years ago has been to plant trees, more especially in this State, much too deeply, with the idea that during our dry summers, the roots should be put as deep down into the ground as possible so as to insure a proper amount of moisture being always within their reach. Collar rot, the rotting of the roots, stunted growth, are all due to this defective method of planting,

and to this cause mainly must be attributed the loss of so many fruit trees planted in this country. Deep planting, insufficient pruning, deficient cultivation, neglect of pests, may be said to be at the bottom of the failure of a great many fruit trees in this State.

As a general rule, if the soil in which the tree is planted is the same as the one from which it was taken, the tree should be set the same depth as it was before it was removed from the nursery row. If the soil is heavier, the tree should be set a trifle shallower, if lighter it should be planted a shade deeper.



Tree too deeply planted. Tree rightly planted. Tree set too shallow.

The above illustration shows the wrong and the right way of setting a tree. The horizontal line represents the ground surface. On the left hand side is an illustration of a tree badly planted, after the fashion beginners generally favour. A deep narrow hole is sunk into the ground, the tree is let down with its roots twisted anyhow, and covered with soil, or worst of all, soil with stable manure poured over them. If the ground is at all heavy the roots will with difficulty penetrate through the wall of such a hole, the earth packed around the bark will prevent the butt of the tree expanding, the bark will lose its elasticity and will set tight around the tree, which will either die of collar rot or will always be stunted and live a miserable life. The figure on the right shows another extreme; it represents a shallow hole with the roots simply resting two or three inches below the surface. Such a tree will be easily blown down by wind storms; its roots will suffer severely from the heat of the sun, or will run the risk of being desiccated during the dry summer. Such shallow planting is only to be recommended on damp, peaty ground, where the water still lies within two feet of the surface, and where drainage is somewhat difficult to secure. Between these two extremes lies the right way of setting a tree.

How to Manure when Planting.

If the trees are planted late in the season, when dry weather sets in, it is advisable to pour a bucketful of water around the stem to settle the earth well on the roots. Mulch the ground about the newly planted trees with a light coating of stable manure or of straw.

Fertilisers are sometimes used at the time of planting for giving a good start to the trees, but avoid putting farmyard manure under the roots of the plant, as it would in many cases attract insects and favour the growth of parasitic moulds that would be injurious to the tree. Of chemical fertilisers a couple of handfuls of phosphates and potash manures mixed will in many cases prove of great value, well worked with the earth round the roots. Whenever farmyard manure is used, it should be in the form of a mulching on the top of the soil as its beneficial effect will then be twofold; the plant food it contains will be washed from the surface down to where the roots are established by the winter rains, and it will act as a screen which will be of considerable benefit to the plant by preventing the evaporation from the soil, and by smothering any weeds that might happen to grow round the trees. When the planting is done on freshly-cleared ground, sour and heavy lime is an excellent preparation. The places where the trees are going having been marked, 6lb. to 7lb. of lime are spread around the stakes; the holes are subsequently dug and the trees put in. This will correct the sourness and the stiffness of the soil and induce a healthy growth. Some open up the tree-hole some time before planting, but if the ground is at all stiff and heavy, the liming as described above is preferable. Unless this dressing is applied it often happens that the sides and bottom of the holes are coated with a viscous glaze which prevents the tender roots reaching to the soil beyond.

After all the precautions have been taken for insuring the proper planting of the right sort of trees, all the efforts of the beginner are often frustrated by neglect of another important detail. The newly planted tree must be cut back, or shortened in, or else its growth will be checked, and it will not uncommonly perish. So long as it was in the nursery, the root system of the young plant was unimpaired, absorbing from the soil all the nutriment the branches required, but when taken up, no matter how carefully done, many of the fine feeding rootlets are torn and bruised, the feeding capacity of the tree is no longer in keeping with the amount of shoots it carries, and unless the superabundance of these is cut back and the balance re-established between the feeding and the breathing and evaporating organs of the plant, it will make a miserable struggle for existence and in many cases even perish. The bark will become leathery and limp, the sap will heat and ferment under the action of the sun, and the tree will fall an easy victim to the attacks of borers and other noxious insects.

As soon as ever the operation of planting has been done, it will be found of the greatest use to draw a map of the orchard on which

is indicated the respective position of each tree, with numbers which will refer to an index carefully recording the name of the trees planted. With such a plan, although labels may be lost or torn away, no possible mistake can happen at any time regarding the correct name of any tree grown in the orchard.

Labels for Fruit Trees.

More especially in the home garden a variety of trees is often planted, and as it would be inconvenient to keep continually referring to the map of the ground to ascertain the name of trees, it is advisable to attach labels to them.

Of these several kinds are sold by seedsmen and florists. The zinc labels at first look very neat, but unless they are punched with letters or definite marks the writing disappears after a season or two.

Cheap and convenient labels are ordinary painted pine labels, 1½ inches wide and 6 inches long. A piece of galvanised wire is fastened to them at one end. The name of the tree or plant is written with a soft pencil upon the label, which is then dipped in white of lead well thinned with oil. The paint at first obscures the writing, but on drying the lettering comes out again more distinctly, and remains visible for quite a long time.

THE PROFESSIONAL RABBITER.

By H. M. Wilson, Secretary Rabbit Department.

The rabbit question, which has at last forced itself into recognition as a live one in Western Australia, is one which has demanded and received very serious thought for many years in the Eastern States and New Zealand.

The innocent and festive little rodent, whose first appearance in various parts was so welcomed as a means of affording a highly enjoyable afternoon's sport, and an occasional delectable change from the standard beef and mutton diet, has gradually asserted himself as an aggressor—a landgrabber of the worst kind, disputing with proud man his possession of the soil; and, when once his hold on the country is solidly established, almost defying the efforts of human intelligence and scientific skill to effectually master him.

Fortunately in this State we possess the advantage of having handed to us a knowledge bought by bitter experience in other

parts of Australasia, which enables us to avoid some of the expensive errors which our Eastern fellow-colonists fell into in their earlier efforts at rabbit suppression. One of these is the system which brought into existence the professional rabbiter. This profession—generally the *dernier ressort* of the needy flotsam and jetsam of colonial humanity—soon developed into a fine art, aiming at how best to accumulate the profitable scalp without actually "killing the goose that laid the golden egg." Though not overburdened with scientific knowledge, the fact was early borne in upon the rabbiters that to exterminate the does, and particularly does in young, was a menace to the profession; on the other hand, to wipe out the large majority of the bucks was to put into operation a law which greatly tended to fertility. No secret was made by these men of their practice of sparing does so that more grist might continue to come to their mill, and I have heard the desire for the propagation of this fruitful source of income expressed in the words of one old hand to a beginner, "Go down on your knees every night and pray for the increase of rabbits." To destroy most of the bucks was to create a polygamous state of existence which is recognised as favouring increase. An excess of bucks over does, on the other hand, leads to a much greater number of the young being killed by the bucks, the prostitution and worrying—even to death—of the does, and a consequent largely reduced fertility. So fully is this recognised by some pastoralists that the presence of buck rabbits is actually encouraged by them. Mr. Rodier, of Tambua Station, in the North-West of New South Wales, insists upon no bucks being killed on the station, and actually goes to the trouble of trapping his neighbours' rabbits, and having the captured bucks placed alive over his side of the boundary fence. By this means he claims that the rabbits make so little headway on his run, that its stock-carrying capacity is rendered higher than that of any of the better class runs within 100 miles of him, and that one man can easily keep the pest in check on his hundred square miles of country.

The rabbiters, however, pursued the opposite course of encouraging polygamy instead of polyandry, with beneficial results to themselves, and rabbiting as a profession advanced at such a rate that 27,000,000 scalps were paid for by the New South Wales Government in one year, and it was estimated that over 3,000 men were employed at the business of trapping. Some of these amassed quite respectable little fortunes, and the writer knows three brothers who, within three years, cleared over £1,000 a-piece. A professional rabbiter in some parts was almost looked upon as a magnate of the district; the magnificence of his equipage put into the shade that of the so-called "lordly squatter," the style he affected was immense, and it was no uncommon thing for a boss rabbiter, on visiting the nearest town, to treat his friends to a gorgeous champagne supper. In payment for a sixpenny drink, one of these prosperous individuals one day tendered a cheque for something over £1,070, and it was such ostentatious displays as these that led to the phrase "Rich Rabbiters and Ruined Squatters."

Naturally this state of affairs could not be allowed to go on for ever. The Select Committee of the Legislative Council of New South Wales, appointed to inquire into the working of the Rabbit Nuisance Act, reported that—" The persons employed in the supervision and destruction of rabbits are more or less interested in the perpetuation of the pest, which is spreading farther and farther"; and, after the fruitless expenditure of over £600,000 of public and £200,000 of private money, it was tardily decided to alter the system.

The rabbiter still exists in some of the Eastern States in a quiet way, and makes fair wages in procuring the carcase for the local market, and for export; but the day of big bonuses for scalp money, and the weekly pocketing of a £10 or £12 cheque for destroying, has gone by—let us hope never to return.

THE CULTIVATION OF PUMPKINS AND SQUASHES.

By Percy G. Wicken.

Several inquiries having been made of this Department as to the best method of cultivating pumpkins on a large scale for market purposes, I will endeavour, in the few accompanying notes, to explain the methods adopted in the Eastern States in which the cultivation of pumpkins and melons is carried out on a large scale, and, even at the comparatively low prices that are obtained, are a profitable crop to the farmer. Pumpkins are also a very valuable article of fodder for the farm, and especially to those engaged in dairying. They are easy to harvest, will keep for a considerable time, and can be stored at very little expense, and used as required.

Soil and Climate.—Pumpkins can be grown in any of our semi-tropical and temperate climates, and will thrive almost equally well on the sea coasts as on the mountain ranges further inland, provided the rainfall is sufficient to enable the plants to make a start with their root growth before the weather becomes too hot. I have seen them growing to equal perfection in the warm districts of the Riverina, on the mountain ranges 4,000 feet above sea level, and also on the sandy flats along the sea coast. Although the plants do well on most soils, the best results are obtained on a good, deep, well-drained, friable, loamy soil, which, when well worked, retains the moisture during the summer months, and also enables the roots to penetrate well down into the subsoil, and

thereby to withstand the effect of the dry weather during the hot summer months.

Method of Cultivation.—Pumpkins being a crop that make all their growth during the hottest time of the year, and owing to its habit of growth, the vines trailing along the ground for long distances, they are exposed to the full force of the sun's heat. The amount of water evaporated from the large leaves and moist stems of this plant is very great, and as this supply of water has to be obtained by the roots from the soil, it follows that deep cultivation is necessary. This can best be performed by subsoiling the ground in the autumn previous to sowing the crop, and can be either carried out by a special subsoil plough, or by using two ordinary ploughs, following one another with the mould board removed from the second plough; the first plough will turn a furrow seven or eight inches deep, the second plough following breaks up the ground in the same furrow to a further depth of eight inches. This operation makes a deep bed of well worked soil, which is able to hold a large quantity of moisture, and so long as the surface is kept constantly stirred very little evaporation will take place, the well worked surface soil acting in the same way as a mulch, and by destroying the capillary action of the surface soil prevents the evaporation of the moisture. After the ploughing is completed, the land requires to be harrowed, and rolled or disced, until it is worked up to a fine tilth.

The land is now ready for the drill-plough, and drills are marked out across the paddock in both directions, at a distance of from 10 to 14 feet apart, according to the quality of the soil and the habit of growth of the variety of pumpkins that are to be sown. The richer the soil the further the plants require to be apart, as the plants grow stronger and throw out more vines; the poorer the soil the closer the plants may be together.

We now have the paddock marked in small squares, say 12ft. each way. It is then ready for making the "holes" or "hills," as they are called, and this is performed by means of a prong-hoe, at the intersection of each drill, the soil is worked up by the prong-hoe to a depth of about eighteen inches, and made into the form of a hill and all lumps broken up, couch grass, etc., removed, a good size handful of manure, superphosphate is preferable, worked in, and the hill levelled off so as to come about one inch above the level of the ground, and to be not less than four feet in diameter. This operation is very similar to making a hole for planting a tree. At a distance of 12ft. apart each way this will give about 300 hills per acre.

In many instances where the expense of subsoiling the whole of the ground cannot be incurred, a method is adopted of subsoiling a strip six feet wide where the "hills" are to be worked and leaving the balance undone. This is not a good system, as the succeeding crop, which also derives a great benefit from the subsoiling will become very patchy and uneven, growing well on the subsoiled part and

not so well on the other part. Also the saving effected is very small, as while the subsoiler is at work on the block of land the subsoiling can be done cheaper at one operation than if the other part has to be finished afterwards.

Sowing Seeds.—About five seeds is sufficient to sow in each hill, and they should be sown a few inches from the edge of the hill and at an equal distance apart. The best way to plant them at an equal depth is to drop the five seeds on the ground in the position required, then press them in with the thumb to the depth of the first joint, by this means an even depth of planting is obtained, and the operation only takes a few seconds. A large area of land can be sown in one day by one man.

After Cultivation.—After the seed is sown, the harrows require to be run over the ground several times to keep the weeds in check, and as soon as the vines show signs of commencing to run, the land between the rows should be ploughed up by a single-horse plough, throwing a furrow on each side as near to the "hills" as possible without burying the young plants, and finishing off in the centre between the rows, the harrows are then run over the ploughed ground and no more cultivation is necessary until the crop is harvested. The vines grow very rapidly after this stage is reached, and in a very short time the whole of the area is covered with a thick growth.

Most of the early flowers that appear on the vines are of the male variety, and bear no fruit; the female flowers come slightly later, and, being fertilised, wither and drop off, leaving the small bulb which forms into the pumpkin, in exactly the same manner as the blossoms drop from a fruit tree leaving the minute fruit behind. The pumpkin beetle attacks the leaves of this plant in the early stages of growth, and these can be kept in check by spraying the leaves with a mixture of Paris Green, mixed in the proportion of 1lb. to 160 gallons of water. This requires to be kept well stirred while spraying.

A method often adopted by farmers who go in extensively for pumpkin raising is to grow the crop in conjunction with a crop of maize. Five or six rows of maize are sown and then two rows are missed, and in this space a row of pumpkin "hills" are made, the tall maize stalks shield the pumpkins from the sun, and some excellent results are sometimes obtained. This system requires good soil that contains plenty of moisture, but where the soil is anyway dry the crop of pumpkins will have all they can do to obtain sufficient moisture, and they will require the whole use of the ground.

Cost of Production.—As to the cost of production, I cannot do better than quote the cost and cash returns from a crop grown by the writer at the Hawkesbury Agricultural College, and which is published in the annual report of that institution. The following is an extract from the report:—

"A four-acre block of pumpkins and squashes was sown, and the results are very satisfactory. Although the soil was poor, we obtained a total yield from the four acres of 47 tons, and the financial results were as follows:—

	£	s.	d.
Cost of ploughing, discing, harrowing, rolling, manure, striking out drills, working hills, seed, and after cultivation for 4 acres ...	7	13	6
Harvesting and carting to station	5	17	6
Railway freights	9	10	4
	23	1	4

	£	s.	d.
Value of pumpkins sold—net returns from auctioneer	42	18	0
Less cost of crop	23	1	4
	19	16	8

Showing a profit of £4 19s. 2d. per acre after paying all expenses, and this with the pumpkins being sold at the rate of only 18s. per ton."

Varieties.—There are a large number of varieties of pumpkins and squashes, and although they are known under the different names, it is hard to say where the difference between the pumpkin and squash comes in. The term squash in the first instance was used to signify the softer varieties, such as the vegetable marrows, but now many of the varieties called squashes are as hard as the hardest ironbark pumpkins. Some of the pumpkins are quite soft. The two terms may be taken as synonymous.

There are both bush and running varieties; the best of the bush and close-growing varieties are the delicata, white and yellow bush squash, pineapple squash, and summer crookneck. The best eating varieties among the strong-growing varieties are the ironbark, Hubbard, Turk's head, crown, button, banana, Pike's peak, and Warren squash.

The large varieties grown, mostly for cattle feed, are the large grey cattle, large red cattle, French pot-iron, hundredweight, mammoth Chili, French striped, and others.

Another variety, which is mostly grown in this State, is the gramma, or rio, also known as the bugle or trombone pumpkin. This is a sort of general purpose pumpkin. It can be used either for food for stock, or as a vegetable. It is excellent boiled or baked. It is the favourite sort for making pumpkin pies. Flavoured with either pineapple, lemon, or ginger, it makes a very rich jam. It will keep if stored in a dry place all the winter, and is always valuable as a stand-by when other vegetables are scarce.

Some varieties will do better in one district than another, and this can only be found out by growing several varieties, and then keeping to the one that proves most successful. Although I have

mentioned a number of varieties of pumpkins, when grown for market purposes or for raising for seed, no two varieties should be planted in close proximity to one another, as they are plants that very readily cross-fertilise, and although this may not appear to disadvantage in the first crop, the seed saved from this crop will produce all sorts of cross-bred varieties. If only grown for food for stock, this does not much matter, but if for market or seed purposes, it greatly deteriorates the value. In the United States of America whole districts grow only one variety of pumpkin, and the varieties are thereby kept pure.

Harvesting.—One of the advantages to be derived from this crop, especially where labour is scarce, is the easy manner in which the crop is harvested and forwarded to market. No expensive machinery is required, no reapers and binders, strippers, or thrashing machines, etc. All that requires to be done is to drive a wagon through the paddock, load up the crop, and cart to the railway station and place in the trucks. This alone should prove a great consideration where a quick return at little outlay is required. Should the price be low at time of harvesting, they can be left on the ground for a considerable time, or carted to the sheds and stored until required for sale or home use. In forwarding to market, it is much more profitable to grade the pumpkins into sizes and varieties before sending for sale. A nice truck of even-sized pumpkins, whether of a large or small size, will fetch a better price than a truck which contains a mixture of all sizes and varieties, and will probably lead to inquiries for a further supply of the same sort.

MULE BREEDING.

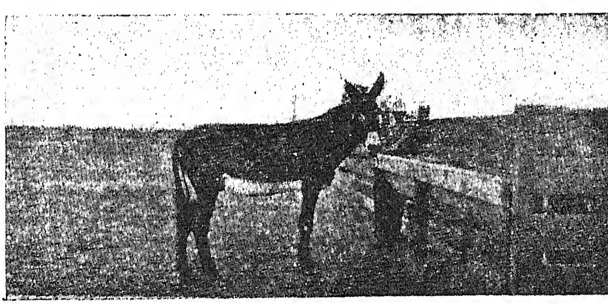
It is the object of this article to give some information which may be useful to those in a position to rear mules, also to compare the value of mules with that of other similar draught stock. The experience quoted is that obtained at first hand in the Middle and Western States of America, and when it is stated that during the last completed fiscal year, ending June, 1901, there were shipped on British Government account to South Africa over 26,000 mules from the ports of New Orleans and Galveston alone, it may be assumed that the raising of such stock in the United States is far past the experimental stage. Although mules are largely reared throughout the Middle States, the hardiest are bred in the lower regions of the Sierras and the Rocky Mountains, the main characteristic of which is broken stony country, interspersed with small valleys, where there is always plenty of water, and in which coarse natural grasses are in greater or less abundance in accordance with the season. This entails much travelling of the stock over the rocky ground to pick up a living, also exposure to the severe winter

weather which prevails. Much importance is ascribed to such conditions, and it is claimed in the comparison of the relative value of mules and horses that the lesser necessity for shoeing mules, the less nutritious food upon which mules will work and grow fat, the lesser liability to sickness, and their greater longevity are largely due to the conditions to which the mules have thus been accustomed when young.

In former years many stallion jacks were imported from France and Spain for use in America, but latterly the jacks bred in Kentucky are considered equally good; excellent jacks are also bred in the States of California, Washington, and Oregon, on the west coast.

In selecting mares for mule-breeding particular attention is given to size and bone, combined with as much quality as circumstances may allow. Those preferred by many are the progeny of Clydesdale stallions and Norman mares, from four years of age and upwards, even to fifteen years if constitutionally sound. Breeders consider the size of the jack to be less material so long as he readily covers mares, is a foal-getter, and has good offspring. Long-legged, large-bodied jacks are not in favour, but relatively small, nugetty animals, having plenty of bone and small heads, are preferred. In America the true value of a jack is very properly assessed by his first year's colts. If these are attractive his value is doubled forthwith, and further enhanced as such develop satisfactorily.

The accompanying illustration is of a Californian-bred jack. Such jacks are about $14\frac{1}{2}$ hands in height, from 65in. to 75in. in girth behind the shoulder, and weigh 850 to 900lb. at five years.



American Jackass,
6 years old; $14\frac{1}{2}$ hands; girth, 5ft. 6in.; cannonbone, 9in.; forearm, above knee, 15in.; weight, 885lbs.

The present value of such animals at the ranches cannot be put at much less than £200 each for four to six-year-old jacks having good offspring in evidence. To this is to be added £40 or £50 for expenses and freight by mail steamer, say, £225 to £250 landed in Australia or New Zealand. In America special care is exercised in keeping jacks intended for mule-breeding apart from other donkeys or mules. It is customary for such a jack to be weaned at an early age, and

from that time kept apart from other donkeys and mules, and let run with horses. It is stated to be necessary to keep jacks intended for covering mares beyond even the smell of mules. At three years of age the jack is broken to serve mares, and is then kept in a large roomy loose-box apart from other animals, in most cases also in semi-darkness, and, as a rule, he is not allowed to see any other animal but the mare he is brought out to cover. It is found that jacks so treated take readily to mares.

It is noticeable that very great care is usually taken of the jacks, even to the extent of keeping their stalls flyproof. Hard floors to the stalls are also considered essential, owing to the habit some jacks have of standing in soft ground on the fore parts of the hoofs, which gradually causes malformation, which is said to be transmissible to the offspring. It is said that a matured jack, if properly fed, exercised, and handled, should serve from 60 to 70 head of mares in a season, and get from 60 to 70 per cent. of foals. In America it is considered preferable to put two mares to the jack one day and one mare the next day, it being the opinion that by so doing the jack keeps vigorous throughout the whole season. The mare to be served is generally first teased with an entire horse, and not put to the jack before she is ready to receive him. She is then backed into a shallow pit sloping towards the rear, and enclosed with railing about 4ft. high in front, and 2ft. behind, with width according to the size of the animal. A light bar is passed in front of the mare's breast, and, to obviate the chance of her kicking the jack, a stout frame of planking is inserted behind her heels.

Provided the above precautions are taken it is not found that there is trouble in getting jacks to cover mares, but most breeders are agreed that if a jack be allowed to cover a "Jenny"—a female donkey—he will not afterwards cohabit with mares during the same season, and it is said to be frequently the case that he will not again cover any but his own kind.

It can readily be imagined that jacks treated as above described develop peculiarities. Vice, however, seems to be generally absent, but there are frequent cases on record of accidents due to nervousness of stallion jackasses. In one case a farm hand who had been attending to some jacks for several years, purchased one, and started taking him elsewhere. When fording a comparatively shallow stream the jack became alarmed when the water touched his body, and deliberately drowned himself, despite the efforts of his owner, who, being alone, was helpless.

Mules, as a class, are generally regarded by people in Australia and New Zealand as being mostly small animals of light weights, and, consequently, less useful than horses for the heavy agricultural and cartage work mostly required. Such description correctly applies to most of the animals hitherto reared locally, but that both size and weight is as obtainable, with proper breeding, in mules as in horses, can be gathered from the following particulars of a large number of mules purchased last year in America for the Fiji estates

of the Colonial Sugar Refining Company of Sydney, to whom we are indebted for the information.

WEIGHT OF MULES PURCHASED IN AMERICA, 1901.

	Mules.
Under 1,000lb. each	54
From 1,000-1,100lb. each	263
From 1,100-1,200lb. each	210
Over 1,200lb. each	87
Total shipped	614

Ages, 4-6 years.

Height, $14\frac{1}{2}$-$16\frac{1}{2}$ hands.

The twenty heaviest mules ranged from 1,310 to 1,580lbs. each.

Mules are not generally valued by their apparent indications of good breeding—which are usually important factors in the selection of horses—but by their bone and the weight they scale. They are seldom as fleshy as horses, and it is probably within the mark to say that two 1,300lb. mules will draw heavier loads in constant work than two horses each weighing 1,400-1,500lb.

The general manager of the Sugar Company informs us that values in America for the stock they purchased were found to range from £15 to £20 per head, also that the expenses and the freight to Fiji about doubled the prime cost. Their experience, however, was that for the heavy work necessary under trying conditions of a tropical climate, such relatively higher cost of mules from America, as compared with horses from Australia, was fully warranted by the less expense for fodder, by the lesser liability to sickness, and by the greater longevity of the mules, regarding which points the following experience of large numbers of mules during several years is allowed to be quoted for information:—

RELATIVE COST OF FODDER AND DEATH RATE.

		Horses.		Mules.
Fodder	As	1	to	3
Death rate...	As	$2\frac{1}{2}$	to	1

In other words, three mules are fed at the cost of feeding one horse; and, with equal numbers of horses and mules working, five horses are lost by death for every two mules that die.

Owing to the expense inseparable from shipments of live stock by the mail steamers it is unlikely that American mules will be imported to any extent into New Zealand, but it is our opinion that conditions similar to those described above, as suitable for the rearing of mules, are to be found in many districts of Australia and New Zealand. Under these conditions mule-breeding should be a profitable business to many farmers who have large grazing areas,

especially as the country for rearing the young stock is often of but little value otherwise. It will also be gathered from the figures quoted above that a good neighbouring market already exists for such stock. Co-operative effort should allow of good jacks being imported, each for general use amongst those co-operating in any given district; and eventually "Jennys" might also be brought down, so that by the local breeding of the jacks the cost of these could be appreciably reduced.—*Pastoralists' Review.*

POULTRY.

By Alex. Crawford.

The poultry that are being imported by the Agricultural Department are of three classes, viz., table breed, laying breed, and general purpose breed. The table breed is represented by a pen of Silver Grey Dorkings from the well-known yards of Mr. H. V. Hawkins, of Melbourne, and consist of a cockerel and four pullets. With the exception of the Old English Game these are the oldest breed of British poultry. It has this peculiarity not found in any other British breed, that of having five toes on each foot. The only other breed having five toes is the Houdan, or, as it is sometimes called, the French Dorking, but this is a French breed. There are several varieties of Dorkings: the Coloured or Grey Dorking, the Silver Grey, the White, and the Cuckoo. Of these the greatest size is attained by the coloured variety, but they are not nearly such good layers as the Silver Greys, and there is not more at the utmost than a pound in weight in difference between them. At twelve months old a good Silver Grey Dorking cockerel should weigh, in fair condition, between nine and ten pounds, but at two years old they will sometimes attain a weight of 13 to 14 pounds. On suitable soils the Dorkings are easily kept and easily reared, and as free from disease as most fowls.

Rearing of Dorking Chickens.

Many people are afraid to keep Dorkings on account of supposed delicacy in the early days of their chickenhood. Provided they are not kept on heavy clay or damp, low-lying lands they are not delicate, although often they are difficult to rear, but that difficulty is from improper feeding more than from any other cause. The Dorking chicken grows very rapidly, and feathers quicker than any other variety, and consequently needs more nourishing food than other chickens will do, once given that and there is no difficulty in rearing them. Mr. H. V. Hawkins, the most successful Dorking breeder in Australia, in a letter to the Department, gives the

following excellent advice on the subject:—"Feeding Dorking Chickens.—Oatmeal, steeped in hot water, *dry*, and mix with ordinary bread crumbs (brown bread best), every three hours for first week, after which give in the evening millet seed for ten days; from this period barley meal, bran, and oatmeal, mixed hard; add to this bonemeal, dry, and crushed wheat, short white oats. One thing in particular is very important: give plenty of raw onions, cut fine, and garlic is one of the best tonics they can have. After they are four weeks old a little boiled meat, minced, helps greatly the growth of feather." They may require a little extra trouble, but they are worth it, and they grow so rapidly that they are fit for market before any other breeds are, and will bring the highest prices.

The soils that they do best on are dry, well drained sandy loams, gravel or limestone. On low-lying and damp soils, and on clay, they are very subject to disease and difficult to rear when kept pure, but this does not seem to apply to crossbreds. I have successfully reared crosses between the Dorking and the Wyandotte, Leghorn, Minorca, and Orpington on damp clay soil with no more mortality than among the other breeds.

A good laying strain of Dorkings, under suitable conditions, will lay from 120 to 150 eggs per annum, and when the young stock are sent to market will fetch the highest prices going. Where only the laying strains of poultry are kept, and it is desired to improve the table qualities of the young stock, there is no better cross than the Dorking. It will make a wonderful difference in the size and decrease the egg production to a very small extent, and the slight decrease in numbers will probably be made up for in the increase of weight. The eggs of the Dorking are of good size and a pure white. We have had some very good birds of this breed in this State, but they have degenerated greatly of late through in-breeding, and those who keep these fine old English birds will now have a chance of getting new blood and improving their stocks.

Hamburgs.

The next breed I will describe is the Hamburgs, and these have been obtained from the yards of Mr. Thos. Hutchinson, of Mornington, Victoria, one of the largest if not the largest breeder of Hamburgs in Australia. There are a number of varieties of Hamburgs, viz., Blacks, Whites, Golden Spangled, Golden Pencilled, Silver Spangled, and Silver Pencilled. Of all these the best layers are the Black and the Silver Spangled; the former are the larger birds and lay the larger eggs, but for numbers the palm must be given to the latter. The Hamburg is of especial value for crossing with the heavier birds to increase their laying qualities. In fact the two best general purpose fowls we have, the Orpington and the Wyandotte, owe their best laying qualities to the introduction of Hamburg blood.

Although the Hamburg lays a small egg, those of the black and silver spangled varieties are not much, if anything, inferior in size to the Brown Leghorn, and they lay a greater number of eggs per

annum. The blacks will average probably about 230 eggs, and the silver spangled 250 eggs per annum if selected from good laying strains. I have had a pen of four of the latter that gave an average of 263 eggs each per annum for two years. Hamburgs are not only among the most graceful and beautiful of all our varieties of poultry, but one of the most profitable, They are hardy and very free from disease when allowed a free run. but they do not do well when confined. The chickens must have a free run also to be reared successfully. With a wide range to go over, the Hamburgs require less feed than any other breed. They are active, nearly always on the move, and get the most of their food for themselves, going long distances from home in search of it, but never getting lost. They are of a shy disposition, and even when reared in an incubator they seldom become tame like other fowls. With all their good qualities they have one bad one that prevents many persons from keeping them, and that is their destructiveness to a garden. They are most persistent and inveterate scratchers, and two or three in a garden for half an hour will do as much or more harm than a pig.

Where they can be kept away from a garden, or there is no garden for them to destroy, I can recommend either the Black or Silver Spangled Hamburg as one of the most profitable fowls that can be kept. They do not sit.

The other breed imported by the Agricultural Department, which is a general purpose breed, is the "Buff Orpington." These birds have been obtained from the yards of Mr. G. E. Andrew, Melbourne, who makes a speciality of this breed. Any of our farmers who have ever kept any of the various breeds of Orpingtons know what good layers they are in the winter, and what good prices the young stock bring when sent to market. There are a great variety of Orpingtons, among which may be mentioned Black rose combs, Black single combs, Whites, Jubilee, Spangled, and Buffs. Of all these varieties the most profitable is probably the buff. It is an excellent winter layer, and also lays a large number of eggs; it is a quick growing bird, hardy and healthy, and does well in almost any climate. In America and England these birds are particularly popular, and deservedly so, and need only to be better known to become equally so here. Being a made up breed, they are not so useful for crossing purposes, as they lack the prepotency that stamps their good qualities in their offspring, and much better results will be obtained by keeping them pure. The most successful cross with the Orpington that I have known has been the Hamburg. In this cross the young birds kept up their winter laying properties, and had an increased number of eggs to their credit. There is a considerable amount of Hamburg blood in the Orpington.

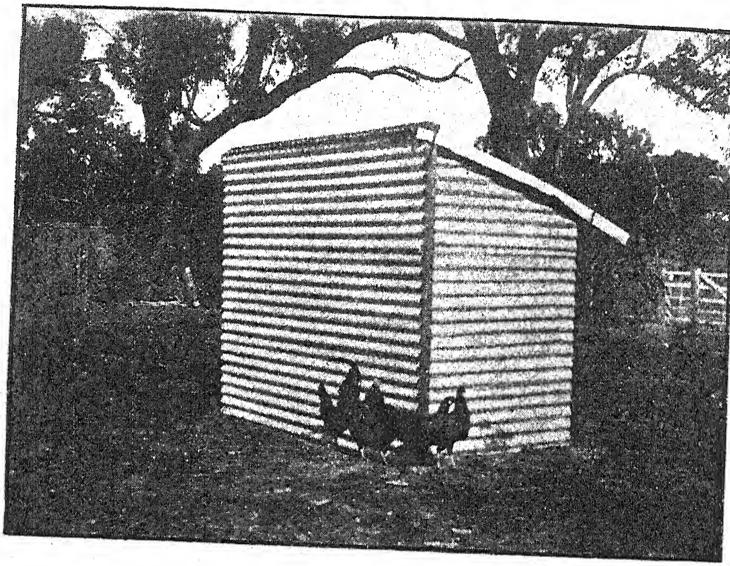


Fig. I.—Showing Back and Side of Fowl House.

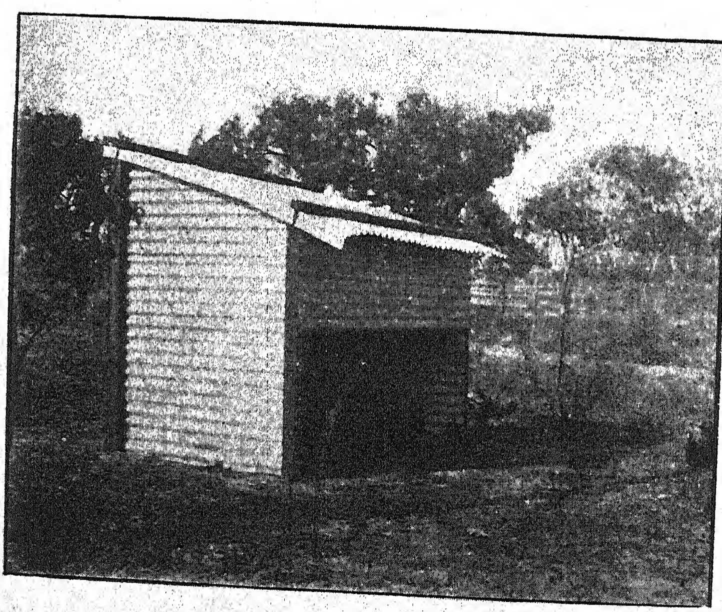


Fig. II.—Showing Front of Fowl House.

TICK-PROOF FOWL HOUSES.

By Alex. Crawford.

The illustrations given in this issue of poultry houses show how they can be erected at a small cost, and be practically tick proof. Figure I. shows the back and side, and Figure II. shows the front.

The house is made of iron, with all the woodwork, which should be thoroughly tarred, on the outside, and from the illustrations a good idea of their construction can be obtained. In these houses the iron used was corrugated, but flat iron for all the building except the roof would probably be better, as at the ends of the corrugated iron there is a liability of draught.

The outside may be painted with some white refrigerating paint, and the inside tarred once a year. The perches can be made tick proof by the use of brackets similar to that shown in Figure III. Here there is a small cup that kerosene can be put into, and it is impossible that ticks can get on the perch so long as the cup has kerosene in it. Another method is to hang wires from the roof and have a cup soldered round the wire in which kerosene is kept and the perch hung on the wires underneath.

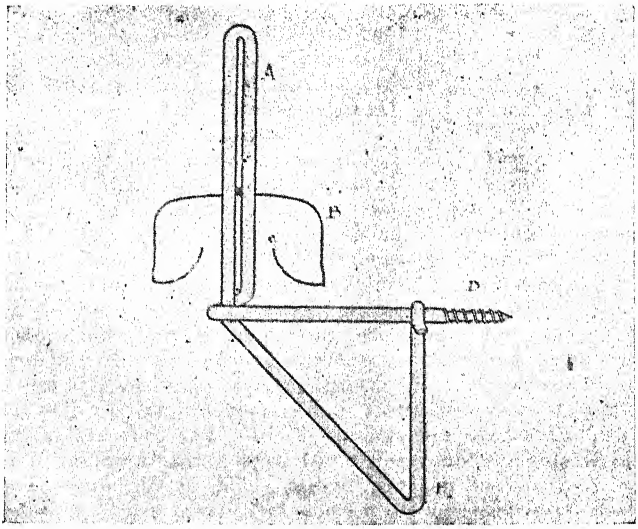


Fig. III.—Support for Tick-proof Roost.

Figure IV. gives a view of some of the poultry houses and yards at the Government farm. The nest boxes should be cleaned out regularly; and, if straw is used, it should be burnt and the box removed just before the box catches fire. By about a month's careful attention to my own yards, which were overrun with tick when I took the place, I cleared them right out, and have not been able to find a tick since. If there are old fences and palings that cannot be burnt, coat them well with boiling tar.

THE MANAGEMENT OF BREEDING GEESE.

There is no branch of poultry-keeping more profitable than the rearing of goslings, and it is a matter for surprise that much more is not done in this connection amongst the farmers, both large and small, in the country. Not only is the breeding of geese so profitable, because of the economic qualities of the birds, but also because they cost so very little to maintain, as after the first six weeks or two months they are able to support themselves well, and as a consequence the expense of feeding them is very slight. Geese are really grazing birds, and if they are allowed access to pasture-land they will require no extra feeding. It is often stated that cattle will not follow geese, but this is not correct, unless, of course, the birds are kept upon the same piece of land until it becomes tainted and fouled. But this would apply to any class of fowls, and not to geese in particular. It is, however, a fact that geese do foul the ground quickly if allowed to remain upon the same piece for long, and, therefore, it is of no use anyone attempting to go in for this branch if the amount of land at their disposal is very limited. Upon waste lands and commons geese thrive remarkably well, and there are thousands of acres of such land in the country at the present time that could be utilised for geese, and not only would the birds do well upon such places, but the land would, in a few years' time, become very much improved. There is much room for increasing the number of geese kept in this country, as the demand is an exceptionally large one. Enormous quantities are imported from abroad every Christmas, and traders tell us that they would much prefer to have home-produced birds, but they are unable to obtain them; hence they are forced to go abroad for them. A few years ago the goose was the favourite dish at Christmas, but its place has been taken by the turkey to a large extent. Notwithstanding this fact, the demand is still greater than ever, because people are beginning to realise that there is no better form of food

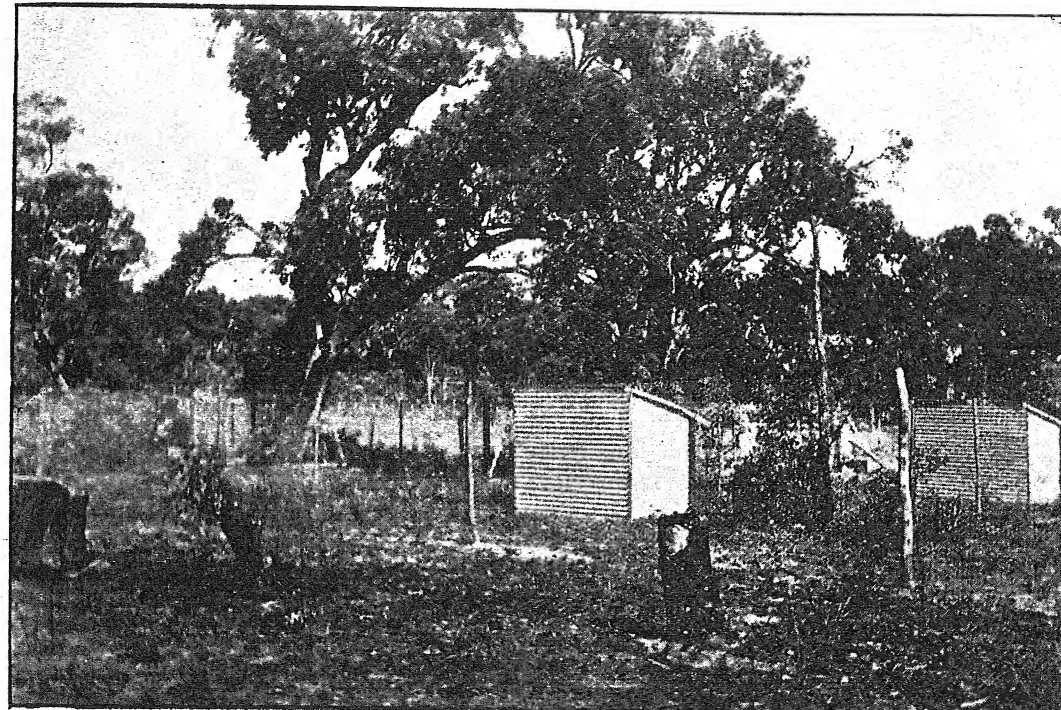


FIG. IV.—Showing general view of Yards.

than poultry in one form or another. There is not the least fear of the supply of home birds exceeding the demand, and as high prices can be obtained for well-grown geese, this branch of poultry-keeping is a very lucrative one.

The trade in geese may be divided into two distinct sections—namely, that of Michaelmas and Christmas, and during the remainder of the year the trade is very slack. Although there are eight different breeds of domesticated geese, yet we need only concern ourselves with two, as the others are rarely seen in this country. The Toulouse and the Embden are the chief ones, and for utility purposes cannot be beaten. The Toulouse is the largest domesticated goose there is, and, like all large animals and birds, is somewhat slow in growth. It is, therefore, not of much use for the Michaelmas trade, but is used almost exclusively for the Christmas. The Embden, on the other hand, which is white in colour, grows more rapidly, attaining maturity at an early age, and this is the breed that comes in for the Michaelmas trade. They do not grow to be as large as the Toulouse, but the quality of the flesh is a trifle better, and the goose is an excellent sitter and mother, which the Toulouse is not. There is a craze at the present time for very large-sized birds, and as more money can be obtained per pound for the large specimens, it pays to breed them as big as possible. We recently saw the following figures quoted in a poulterer's catalogue:—For birds from 7lbs. to 10lbs., 10d. per lb.; from 10lbs. to 16lbs., 1s. per lb.; from 16lbs. to 20lbs., 1s. 3d. per lb.; from 20lbs. to 25lbs., 1s. 6d. per lb., and for larger sized birds the price was proportionately higher. With this craze for huge size we do not altogether agree, because, as will be apparent to everyone, when the birds are so very large the flesh must be coarse, and cannot be as fine in flavour as is the case with a smaller bird. However, as so much more money can be obtained for these huge-sized birds, there is an inducement to breed them large. Therefore, large geese and ganders should be used for breeding, because if small birds are used, that are at all stunted in growth, the offspring must of necessity be small also. Birds that are deep in body, and that have a long keel, should be selected, with strong, well-made frames.

Young geese commence to lay about the middle of February or the beginning of March, and although it is not altogether advisable to breed from young birds, yet if early birds are required, then it is necessary. Goslings from young birds do not grow as quickly as those from older stock, but if they are well bred and not at all weakly or small in size, then they may be used without much fear. The eggs, as laid, should be removed from the nest, because, if this is not done, as soon as the goose has laid about fifteen eggs she will evince a desire to sit, but if the eggs are removed as laid, she will probably lay 30 to 40. The eggs that are removed may be placed under hens, giving three or four to each, according to the size of the bird. For this purpose large-sized birds should be chosen, and generally those of the Brahma type are selected. The period of hatching is thirty days, and it is a good plan to occasionally sprinkle

the eggs with tepid water during this time. The difficulty with geese eggs is that the inner membrane or skin becomes tough and thick, and as a result the gosling has a difficulty in making its way out of the shell. It is found that if the eggs are sprinkled with tepid water immediately before the hen returns after she has been fed and watered, it will greatly facilitate the exit of the gosling.

The housing of geese is a simple matter, and houses at all elaborate are not required. The houses must, however, be well made, and not draughty. Geese do not perch, but sleep upon the ground; therefore, a house four feet high is sufficient. It is preferable if made with a sliding shutter in front, and this during warm weather can be opened, and wire netting being also placed in the front, the birds are kept inside, but have an abundance of fresh air. As a general rule there is upon most farms a shed or an out-building that can be utilised for the purpose of housing the geese, and when this is the case nothing better can be desired. Straw is the best litter for geese, although if reeds can be obtained, and well dried, these form an excellent substitute, and cost practically nothing. Too much stress cannot be laid upon the fact that geese require plenty of fresh ground over which to roam, and it is almost useless to attempt the keeping of geese unless one has plenty of space. It is of little use trying to keep geese in close confinement, as under these conditions they will never thrive well. For breeding geese, a pond or a stream in which the birds can swim is advisable, although it is not necessary by any means. In many districts of France large flocks may be seen feeding off the grass by the side of the road, and these are usually in the keeping of a lad, who attends to them the whole day, preventing them from straying, and drives them back again at nights. In some parts of Norfolk it is there the custom to hurdle geese off on turnips and swedes, the same as is done with sheep. The farmers claim that the geese do equally as much good to the land as the sheep, and they eat off the roots quite as well. It is necessary, when such a plan as this is followed, to provide the birds with suitable shelter at nights, as, with the exception of the height of summer, the geese are much better if housed during the night.

In the next article I propose to deal with the question of hatching and rearing of geese, as it is at this season of the year that hatching operations should be in full swing.—[E. T. B.—in the *Agricultural Gazette.*]

Plot I.—No Manure.

Plot II.—Bonedust and Superphosphate—3cwt. per acre.

Plot III.—Bonedust and Superphosphate—3cwt. per acre, and top-dressed with Sulphate of Potash.

EXPERIMENTS AT BUNBURY.

By Percy G. Wicken.

During last season a number of varieties of plants were grown, under the supervision of the Department of Agriculture, on the farm of Mr. F. J. Hamilton, Glen Iris, Bunbury. A full report as to the results obtained has not yet come to hand. Among the other crops, three small blocks of maize were sown for the purpose of showing the effects of some manures on this crop. The land was of similar quality throughout, the manure and seed were sown under similar conditions, and the results being so pronounced I have taken the opportunity of reproducing a photo. of the plots in the *Journal.* A large label was placed on each block, giving full particulars of the manures used, so that all the surrounding farmers could watch the result for their own benefit. We are indebted to Mr. Kirton, of Bunbury, who kindly took and supplied the Department with the photographs.

Plot 1—Shows the crop as it grew with no manure. The results, as seen, are almost *nil.*

Plot 2—Shows a similar number of rows of maize, which were dressed at time of sowing with a mixture composed of two parts of bonedust and one part of superphosphate, applied at the rate of 3cwt. per acre.

Plot 3—Manure applied the same as in Block 2, but top-dressed early in December with a dressing of sulphate of potash, applied at the rate of $\frac{1}{2}$cwt. per acre. The results of the top-dressing are not so pronounced as they might be, owing to the fact that no rain fell after the sulphate of potash was applied. This manure requires a shower of rain after applying to carry it to the roots of the plants in a soluble form.

AN INSPECTION TRIP THROUGH THE UPPER BLACKWOOD.

By J. S. Jefferson.

Leaving my Balingup headquarters on 19th March, with horse and sulky, I drove to Bridgetown, *via* Greenbushes, thence to Winigup Ford. Here a number of farmers are settled, all of whom are orchardists, and duties detained me several days. I found that, in consequence of the prolonged drought, and universal bush fires recently prevailing, feed was exceedingly scanty, and stock suffering in consequence. In some cases wells, and even the household tank were empty, and settlers even using brackish water. One large owner of cattle had been obliged to turn out his herd on to the Crown lands owing to his 2,000 acre paddock being completely burned. The settlers here, as a rule, have substantially built and fairly comfortable dwellings, but the pioneer work in a country covered with the primeval forest, thick scrub, and blackboy, is a heavy tax on the slender capital with which the majority have to work. Leaving Winigup on the 21st April, I drove through Dwalganup, the residence of the late James Forrest, to Quinjlup close to Lauderdale. From Lauderdale a weekly mail is despatched by horseback. A few miles beyond Dwalganup the road became very bad—in fact, a miserable track—where in places ironstone rock jutted from amongst soft sand. In consequence, progress was slow, and though I hurried on as fast as the road would permit, when the paddocks surrounding Mr. W. M. Scott's residence (where I proposed passing the night) were reached, darkness had completely set in. In the darkness I missed the bush track leading into his farm, and, therefore, continued on for several miles, until at about 10 p.m. I was obliged to call a halt, give my horse a feed, which, fortunately, remained in the nose-bag, and hunted up a sandwich stowed away in a saddle-bag. Then, retracing my steps to Norlup House, which had been passed three hours previously, I woke up the inmates, and asked to buy a feed for my horse and a night's lodging. Mr. Treasure, the owner, after attending to my horse, kindly insisted, although it was then midnight, in lighting a fire and bringing the kettle to a boil. Having replenished the inner man, I slept well after a forty-mile drive, the last ten miles of which were bitterly cold ones.

I would like to mention here the necessity of placing finger-boards at the intersections, at least, of public roads in a district like the Upper Blackwood, where settlement is very sparce, and where the public roads are often bush tracks, not one whit better than the private ones made by the settlers. I had no trouble to find Quinjlup on the following day, where I rested and attended to reporting and

correspondence for the next day's mail. From here I inspected Mr. W. M. Spencer's orchard, also the nursery belonging to Mr. W. W. Folley. The latter place is situated 40 miles East of Bridgetown, and 60 miles from Tenterden. His place is very isolated, and it strikes one he must have been full of the pioneering spirit to settle and make a home in such a situation. His twenty-acre orchard is very promising, and he seemed full of hope and enthusiasm. Mr. Spencer's orchard showed vigorous growth and intelligent care. The land generally in this portion of the Upper Blackwood (the Tweed area) is poor. Some parts are poison-infested, and the dingoes are a serious menace to the sheep-farmer. Mr. W. M. Scott told me that a short time previous to my visit, he had disposed of all his sheep, owing principally to losses from dingoes.

The average settler in the Upper Blackwood district owns from 5 to 10 acres of orchard, mostly apples, and generally in fair bearing condition; from 100 to 500 sheep, and hay ground of about the same extent as the orchard. He usually also owns a few cattle; but sheep, except in those places where dingoes prevail, have proved their superiority over cattle, as a profitable investment. When cattle are kept, the owner must have a coast run to which the cattle can be moved annually. The presence of the zamia in some paddocks causes much loss amongst the cattle herds, giving rise to rickets. English grasses have as yet only been introduced to a slight extent. Where lucerne, *paspalum dilatatum*, and cocksfoot have been given a fair trial they have done well indeed. Mr. Chas. Rose is at present clearing extensively on his Blackwood farm, with the intention of laying down to lucerne and the English clovers. A few published analyses by the Government of representative soils from the Blackwood district, accompanied by a statement of the most suitable and economical manures to use in conjunction therewith, would be appreciated by many settlers.

On the return journey to Winigup I liberated at Dwalganup a number of ladybirds (*leis confromis*) sent from head office to act as parasites on the woolly aphis. I also liberated a number in leading orchards near Bridgetown. Remained another ten days on duty at Winigup, and reached head quarters again on 12th May.

On the return journey the long looked for rain commenced, filling the Tweed River to a banker, and starting brooks which had not run for years.

FARMYARD MANURE.

ITS COMPOSITION AND PREPARATION.

Farmyard manure is generally formed of all the vegetable matters lying about the farm, together with the dung deposited by stock. Now, whether vegetable matter be disintegrated by spontaneous decomposition or by passing through animals, the result is the same. If a quantity of food is passed through an animal which is constantly absorbing air into its system, that air is constantly acting upon the food, and consuming some of it, so that what the animal gives out afterwards is of less value than what it received. If a quantity of straw be trodden down by animals, and thus rotted away, there ensues the same action that proceeds inside the animal; that is, the air acts upon the straw, burning a portion of it, and giving out into the air carbonic acid, ammonia, and water, from the decomposition of the vegetable matter; so that whether you pass the food through the body of the animal or decompose it in the open air, the final result is the same. That which passes through an animal is richer than the ordinary farmyard dung, because of the greater richness of the food it has consumed. If an animal be fed on straw alone its excrements will be no richer, as regards manure, than straw decomposed in the open air, but when you feed upon seed, which contains four or five times more nitrogen—a substance capable of producing ammonia—than straw, and which contains far more phosphates, the excrements are far more valuable than decomposed straw. In no other sense are the results different; so, while you use valuable food because you gain by the conversion of it into beef or mutton, that which is excreted is only valuable because you use a valuable material to produce it.

Value as a Fertiliser.

Of the value as a fertiliser, Dr. Dyer says: Of a ton of farmyard manure about three-fourths is water. It contains also 55lb. to 65lb. of ash, and about 500lb. of organic matter, which is capable of being driven off by burning. Except for its mechanical and indirect benefit to the soil, all the manurial value of this 500lb. is due to the nitrogen which is in it. A ton of farmyard manure contains somewhere about 10lb. to 12lb. of nitrogen, which is in an organic state. But plants are unable to feed upon nitrogen in an organic state, that is to say, in the form in which it exists in the decaying matter of soils and of farmyard manure. Such organic nitrogen only becomes useful as plant food after it has become changed into nitric nitrogen by a process more or less slow and interrupted, which is termed nitrifaction, and which is dependent upon the growth of a minute organism in the soil. The conditions favourable to nitrifaction are warm weather and a moist, porous soil, with enough lime in it. The conversion of the inert nitrogen of farmyard manure goes on with comparative rapidity during the

summer, whilst in winter it is almost at a standstill, and any nitrates that may then be formed are, on arable land, washed down by the rain and lost.

Management of Farmyard Manure.

In the management of farmyard dung there are a few things worth noticing. Some of its constituents are volatile, and go into the air; others are soluble in water; whilst the most worthless are the least volatile and the most insoluble. Ammonia, one of the most valuable constituents of all manures, is the most volatile, and if you allow too great heat in the decomposition of vegetable manures, the ammonia as it is produced is driven off into the air. And again, if all the water that falls is allowed to go on the manure, the soluble materials are washed away, and the dung is robbed of its most valuable properties. Where the manure from the yards is not carted straight on to the land in the autumn, it should be made into a heap, but to preserve the goodness in the manure some special care must be taken. For as the straw and other vegetable matters are there mixed with the dung of animals which generally contains more of the nitrogenous ingredients of plants, a fermentation is set up, and the whole rots rapidly upon contact with the air, and thus great waste ensues. The skilful management of the dunghill succeeds in checking this waste and saving the volatile and soluble substances which if unrestrained escape. Choose a site for the dungheap in a convenient position for access to the land intended to be manured. Then cover the ground to the size of the intended manure heap to the depth of four or five inches of road scrapings, or any loose earth, so as to absorb any moisture coming from the manure, and on this empty the manure from the carts. This should be evenly spread and trodden as the heap is forming. As soon as the heap is about a foot above the ground, to allow for sinking, the heap may be gradually drawn in until it is completed in the form of a steep roof, slightly rounded on the top by the final treading. In the course of building this up, about a bushel of salt to two cartloads of manure should be sprinkled in, and after every few layers of manure a layer of soil spread over the heap.

Finally, when the heap is completed, and a few days have elapsed to allow the heap to settle, the whole should be covered, sides and top, with a layer of three or four inches more soil. Under these circumstances decomposition does not take place so rapidly, the earthy matter preventing it being too light. The great point is to guard against decomposition going too far ; care should be taken to let it proceed slowly and regularly. The heap may be turned over at intervals, and the soil from the top and bottom gets thoroughly mixed with the mass. More soil may then be covered over the heap and left until required. When dungheaps thus formed are resorted to in the autumn for young seeds or for ploughing in on the stubbles, the manure will be found undiminished in quantity and unimpaired in quality—in fact, consolidated. Decomposition then proceeds in the soil, where all its results are

appropriated and rendered available for the succeeding cereal as well as the root crop.

Crops for which it is Suitable.

This would necessarily depend upon the quality of land upon which it is to be used. On clay soils, for instance, being put on and ploughed in the winter for a following corn crop, the value of manure from its mechanical use, apart from its fertilising effects, would be greater than on a light land. By keeping the land open the weather would be able to take more effect on the soil, and in the spring the land would be found drier and work kinder; whereas on thin, stony land a lot of the good of the manure would be washed away and wasted. Some farmers would apply it to wheat, and others to clovers; some to one crop, and some to another. There are advocates of applying manure for the wheats in the autumn, and others for putting on the clovers at midsummer. This latter appears a good plan, as the clover root is better fed and grows stronger, leaving a better root herbage. It appears to me, however, that this plan may be carried further, and instead of applying the manure when the wheat is about to be sown (and running a risk of leaving the land light, as well as taking into account the time required for the carting and spreading) or on the clovers at midsummer, and risking the loss of gases by evaporation, I would apply it

To the Young Clovers

either in the autumn or early spring. The result from this plan is, you give the clovers a thoroughly good dressing, enabling them to grow with much greater rapidity and to much greater volume; you have also a far greater amount of roots produced in the soil, and consequently a stronger crop of clover for either mowing or grazing, and the wheat derives a greater benefit from those roots in the shape of manure, than when you apply the manure to the clover at midsummer, or when you plough up the ley in the autumn. Experiments have been made distinctly showing that it is better to apply farmyard dung to green than to corn crops.

With reference to the best time for applying manure to the land, it has been observed that in considering the crop of wheat, either the autumn or spring on young clovers is the best time, but for spring corn it appears to me that April or May for mangels and swedes as a preparatory crop for barley and other spring crops is the best time; and for these reasons: It has been pointed out that nitrification in winter takes place very slowly, and any nitrates then formed are liable to be lost by washing from the rain, whereas in summer the process is carried out much quicker, and the manure is then in such a form that the roots (either mangels, cabbages, swedes, or other bulbs) can take full advantage of it.—Agricola, in the *Farm and Stockbreeder.*

INSECT PESTS ACT.

MONTHLY REPORT.

The inspection of orchards and nurseries has been busily proceeded with during the past month. As the season for sending out fruit trees for planting is now at hand, I have had an inspection of all the principal nurseries made, and the results are most satisfactory, the stock in all cases being found to be strong, well grown, and quite free from any injurious disease. As a precaution against the possible distribution of pests, nurserymen are required to fumigate all stock before sending it out, and each consignment of trees should be accompanied by a certificate, stating that the trees or plants have been so treated. For their own protection, purchasers of nursery stock should insist on this being done, and decline to accept delivery of trees which are not accompanied by a certificate, as prescribed by the Regulations under the Insect Pests Act. As all imported trees and plants are subjected to a close examination, and are also fumigated at the ports, it will be seen that every effort is made to secure only healthy trees being planted; after which it rests with the grower to keep his trees free from any pests which may appear.

Over 50 orchards have been visited during May, and the San José scale was discovered in two fresh places, though only six trees were found to be affected. The fumigation of orchards in which this disease has been found is proceeding steadily; a number of new tents have been procured, and at the present time some ten tents are being constantly used for the eradication of this disease. The tents are lent free of charge, the necessary chemicals supplied at cost price, and an inspector attends to show the proper method of conducting operations; after which the grower is left to complete the work. The quantity of local fruit coming forward has fallen off considerably during the past month, and but little is now found to be affected by the fruit fly. Some of the oranges and lemons sent to market are badly infested with red scale, and a number of these were condemned. The total quantity of fruit condemned on account of disease in the auction rooms and shops during the month amounted to 33 cases.

Large quantities of imported fruit have been arriving during the period covered by this report, a total of 8,858 cases being received and inspected at the various ports. The condition of the fruit now being shipped to this State, both as regards quality and freedom from disease, is excellent. Out of the total number of cases quoted above, only 71 were found to contain diseased fruit, codlin moth being discovered in 64 cases, and seven cases of oranges were found badly infested with fruit fly. The splendid condition and quality of the fruit now coming from the Eastern States show that plenty of first-class clean fruit can be obtained if

diseased stuff is not allowed to be dumped on our shores, and further emphasises the wisdom of the severe inspection which the fruit has to undergo. Although local fruit has been much more plentiful this season than during the corresponding period of last year, it is interesting to note that the importations of fruit for the past month have largely exceeded those of the same month of the previous year. The total quantity of fruit imported during May, 1901, amounted to 1,599 cases, as against 8,858 received during the same month of the present season. If anything were needed to show that the local market is capable of absorbing a largely increased local output, the figures just quoted would amply supply that deficiency.

G. BUCHANAN,
Chief Inspector.

10th June, 1902.

THE VALUE OF POTATOES AS FOOD.

By C. F. Langworthy, Ph. D.,

Office of Experiment Stations.

INTRODUCTION.

The potato, called in different regions white potato, Irish potato, English potato, or round potato, was first introduced into Europe between 1580 and 1585 by the Spaniards, and afterwards by the English about the time of Raleigh's voyages to Virginia. It is commonly believed to be a native of Chile. Wild potato plants, closely resembling those cultivated to-day, are still found there, though it is a fact worthy of mention that, as the potato has been modified by cultivation, it has largely lost the power of producing seeds, and the cultivated potato differs from the wild in seldom producing seed-bearing fruits. When first visited by Europeans, the aborigines of Chile and adjacent regions cultivated the potato for its edible tubers, and had apparently long done so. It was probably introduced into the United States, especially into Virginia and North Carolina, toward the end of the sixteenth century. It is not surprising that the new food stuff should have grown rapidly into popular favour, when we remember its prolific yield, superior keeping qualities, ease of propagation, and agreeable flavour.

STRUCTURE OF THE POTATO.

The potato tuber is in reality a modified stem, being shortened and thickened to serve as a storehouse for reserve material for the propagation of new plants. The outer skin, which is dry in appear-

ance and usually gray or brown in colour, corresponds to the bark of the rest of the plant. The portion underneath the skin, when exposed to the sunlight, turns green and gives the potato an unpleasant flavour. The outer and inner skin are usually removed when the potato is peeled. The flesh makes up the bulk of the potato.

When a section of the potato is carefully examined, it will be seen that it consists of three more or less well-defined portions, namely, the skin, cortical layer or fibro-vascular layer, and the flesh, which is made up of the outer and inner medullary layers. The cortical layer, which is the portion lying immediately beneath the true skin, and which is sometimes designated as the inner skin, is slightly coloured, containing practically all the colouring matter normally present in the potato, and, as already stated, is the part which turns green on continued exposure to the sunlight. This portion has some resemblance to the skin in general appearance, and is usually removed with the skin in preparing potatoes for the table. Fig. 43 shows a transverse and a longitudinal section of the potato.

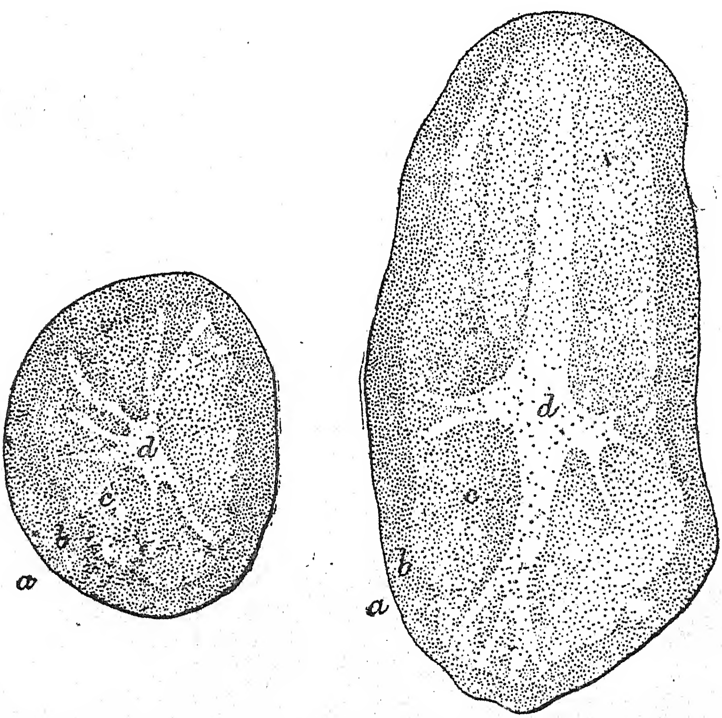


FIG. 43.—Transverse and longitudinal sections of the potato: *a*, skin; *b*, cortical layer; *c*, outer medullary layer; *d*, inner medullary layer.

COMPOSITION OF THE POTATO.

The valuable qualities of the potato were speedily recognized, and there are early records of attempts to determine its food value by means of chemical analyses. In 1795 Pearson reported "Experiments and observations on the constituent parts of the potato root." Einhof, in 1805, published analyses of the potato, as did also Vauquelin in 1817. In America, analyses of the potato were reported some 50 years ago by Emmons. These investigations were useful at the time, although they were not made by the methods generally followed to-day. This was necessarily the case, as the subject of the chemistry of nutrition is of comparatively recent growth. In later years many studies of the composition and food value of the potato have been made in this and other countries.

As shown by recent analyses, the skin of the potato constitutes on an average 2·5 per cent. of the whole, and the cortical layer 8·5 per cent. It is difficult to peel potatoes so that the skin only is removed. Whether both skin and cortical layer, or only the former, should be called refuse in our current sense of the word is perhaps a question. As potatoes are commonly eaten, a good deal of the flesh or edible portion is rejected with the skins. When they are baked with the skin on, much of the flesh is apt to be thrown away with the skin. When they are boiled with the skin on, the amount of edible portion thus thrown away may be very small. When they are pared for boiling, the amount wasted is apt to be much larger. When they are rough from defects in growth, or from shrinking and shrivelling after keeping over winter, the amount of flesh cut off in the peeling is larger still. Just how much this loss of the edible portion of potatoes will average in ordinary households no one can say exactly. In the tables of analyses published in late bulletins of this Department, the amount of refuse and edible portion rejected with it is estimated at 20 per cent. of the whole and the edible portion left as 80 per cent. Doubtless, in many cases the rejected portion is very much larger. The loss of actual nutriment of the

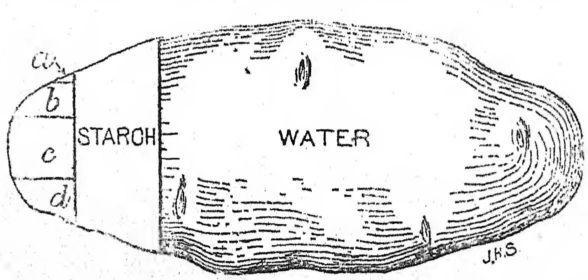


FIG. 44.—Composition of the potato: *a*, fat; *b*, crude fibre and other carbohydrates, exclusive of starch; *c*, protein; *d*, ash.

potato by the rejection of so much of the edible portion with the skin is a much more important matter from the standpoint of nutritive economy than people generally realise.

The edible portion is made up of 78·3 per cent. water, 2·2 per cent. protein (total nitrogenous matter), 0·1 per cent. fat, 18·4 per cent. carbohydrates (principally starch), and 1 per cent. ash or mineral matter. Of the carbohydrates, 0·4 per cent. is made up of crude fibre and materials, which, in some of their modifications, constitute the cell walls of plants and give them a rigid structure. The above figures, like others for composition of food materials, represent general averages, from which there are wide variations in individual specimens. Though the skin, cortical layer, and flesh differ somewhat in composition, they all resemble more or less closely that of the whole tuber. Fig. 44 shows in graphic form the composition of the potato.

When potatoes are stored they undergo a shrinkage. According to tests made at the Michigan Agricultural Experiment Station, this amounted to 11·5 per cent. when they were kept in storage from September 30 to May 1. This shrinkage is probably due to a loss of water by evaporation.

The Connecticut State Agricultural Experiment Station has made a special study of the proteids of potatoes as well as of many other vegetable products. According to these investigations, the potato contains two proteids, a globulin, to which the name "tuberin" is given, and a proteose, the latter occurring only in very small amounts.

It will be remembered that food serves the body in two ways: (1) It is used to build and repair body tissue, and (2) it yields energy for internal and external muscular work and for maintaining the body temperature. Carbohydrates and fat are sources of energy and can not serve for the building and repairing of the body tissue. Protein is necessary for this purpose since it alone of the nutrients contains nitrogen, the characteristic element of the body tissue. In addition to this, protein also serves as a source of energy, and thus while the body could not be nourished on fat or carbohydrates alone, it could be, theoretically at least, on protein, since this nutrient combines the two functions of food. The potato contains some protein, but as the principal nutrient in it is starch, it may be fairly classed as a carbohydrate food. As is the case with all carbohydrate foods, it is chiefly valuable in the diet to supply the body with energy. The potato has a fuel value of 385 calories to the pound, that is, when burned in the body (as all foods must be when utilised), it yields energy equal to the amount named.

Of the total nitrogenous matter present in the potato, that is, the so-called protein, only a little over half, on the average, perhaps about 60 per cent., consists of true proteid, the portion of the protein group which actually builds the body tissues and helps to keep them in repair. The remainder consists of amids and other compounds of inferior food value. Thus, if 100 pounds of the edible portion of the potato contain 2·2 pounds of total protein, the amount of true proteid will be only 1·3 pounds. This deficiency of proteids in the potato is another matter which people generally do not appreciate. It helps to explain why large numbers of the country

population of Ireland and Germany, whose food consists largely of potatoes, are so poorly fed. It is not so much the insufficiency as the one-sidedness of the diet. This is an illustration of the fact that no single article of diet is fitted properly to nourish adult man in health.

As appears from the figures quoted above, potatoes contain a large amount of water. It is largely present in the juice, which consists of water holding various salts and other bodies in solution. In their high water content potatoes resemble turnips and cabbages, which, on an average, contain, respectively, 89·6 and 91·1 per cent. water. Ordinary roller process flour contains only about 12 per cent. water, and a much larger proportion of protein fat, and carbohydrates than potatoes. Rice also contains about 12 per cent. water. Although the protein content of rice is much higher than that of potatoes (being on an average 8 per cent.), carbohydrates make up the bulk of the total nutritive material, and, like potatoes, rice is properly classed as a carbohydrate food. If the value of food is judged solely by its chemical composition, a wrong impression may be obtained. For instance, potatoes as purchased consist of one-fifth and rice of seven-eighths nutritive material. The first inference is that rice is more than four times as nutritious as potatoes. In one sense this is true, that is to say, a pound of uncooked rice contains more than four times as much nutritive material as a pound of raw potatoes. But if we take 4 pounds of potatoes, that is, the amount necessary to furnish as much nutritive material as a pound of rice, the composition and nutritive value of the two quantities will be just about the same, while from pecuniary standpoint the advantage would be on the side of the potatoes. The chief difference in the two foods before cooking is that one is juicy and bulky while the other is dry, and therefore more concentrated. In cooking rice we mix water with it, and may thus make a material not very different in composition from potatoes. By drying potatoes they can be made very similar in composition and food value to rice. Considering the two articles as ordinarily purchased, 4½ pounds of raw potatoes and a pound of uncooked rice contain nearly equal weights of each class of neutrients and have about the same nutritive value.

If a potato is grated and enclosed in a linen cloth and pressed, a large amount of juice will be obtained. The juice thus prepared is a dark-coloured liquid which has an acid character, commonly said to be due to citric acid with more or less tartaric and succinic acids. The mineral matter present is very largely in the form of potash salts. The juice also contains some albuminoids (that portion of the total protein of most value as food), asparagin, and other organic compounds. If the grated potato is mixed with water, starch falls out from the broken cells and settles to the bottom of the vessel, and may be removed in the form of a white deposit. Starch is manufactured to a large extent from potatoes by methods which are similar to the above in principle.*

* For an extended account of the manufacture of starch from potatoes, *see* Bulletin No. 58, Division of Chemistry, U.S. Department of Agriculture.

THE COOKING OF POTATOES.

Although the potato owes its nutritive value principally to carbohydrates, it will be remembered that it contains some nitrogenous matter also. According to the investigations of Lawes and Gilbert, the juice of the potato contains more proteid or albuminoid nitrogen than the flesh. This is an important matter, since albuminoid nitrogen is more valuable for the body than non-albuminoid nitrogen. In general, it may be said that 85 per cent. of both protein and mineral matter in the potato (the latter being valuable for dietetic reasons, though not a nutrient) is in the juice. More or less of the juice of any food may be accidentally lost when it is prepared for the table; and the possibility of loss in cooking, due to this and other factors, is a matter of importance. Any sugar or other soluble carbohydrates might be removed if potatoes were cooked by boiling. No considerable loss of starch as such is to be expected, since starch is insoluble in water. Some starch is changed to a soluble body, dextrin, a sort of sugar, by the action of dry heat, possibly also when water is present.

The principal ways of cooking potatoes are baking, boiling, and frying, or some modifications of these processes. The objects sought are principally to soften the tissues and render them more susceptible to the action of the digestive juices and to improve the flavour. Just why cooking changes the flavour as it does has apparently never been made the subject of investigation. In potatoes, as in other foods, the cooked starch is more agreeable to the taste than the raw. Possibly also there are volatile bodies of

more or less pronounced flavour, which are removed or produced by the heat of cooking. The physical condition of the potato is much affected by heat. In the raw potato the separate starch grains are enclosed in cells with walls composed of crude fibre, a material resistant to digestive juices. If potatoes were eaten raw, the digestive juices would not reach the starch as easily unless the cell walls happened to be ruptured mechanically, as in mastication. Heat, however, expands the water present, ruptures the cells, and breaks up the starch, expanding the granules, which, when raw, consist of tightly-packed concentric layers, to a mass of much less solid structure. These changes are shown in above plate.

The albuminoids in foods are coagulated by heat, and so are rendered insoluble in water in which food is cooked. This explains why foods, meat especially, should be plunged into boiling water if it is desired to retain the albuminoids. The heat at once coagulates the albumen on the surface, thus preventing more or less completely the extraction of materials in the inner portion. It seems probable that this reasoning would apply to potatoes as well as to meat, although they contain much less albumen. The effects of cooking potatoes by boiling in different ways were tested not long ago at the Minnesota and the Connecticut (Storrs) Agricultural Experiment stations. The potatoes were boiled in distilled water, lime water, and alkaline water; part were boiled in water hot at the start, and part in water cold at the start. In some cases the potatoes were peeled before boiling, and in some cases this was not done. In two tests the peeled potatoes were soaked before boiling. The total loss of material (dry matter) ranged from 6·5 per cent. of the total amount present, in the case of the peeled potatoes soaked before boiling, to 0·2 or 0·3 per cent., in the case of the potatoes boiled with the skins on. The greatest loss of total nitrogen and ash was also found when the peeled potatoes were soaked before boiling; least when this was not done. Whatever the method of boiling, little of the carbohydrates was lost. From the experiments as a whole, it may be said that when potatoes are boiled with the skins removed there is a very considerable loss, not only of organic nutrients, but also of mineral salts. To obtain the highest food value, potatoes should not be peeled before cooking. When potatoes are peeled before cooking and placed directly in hot water and boiled rapidly, less loss of materials is sustained than when they are cooked in water cold at the start. If potatoes are peeled and soaked in cold water before boiling, the loss of nutrients is quite considerable; in the case of proteids, being equal to one-fourth of the amount present. The loss in a bushel of potatoes thus cooked would be equivalent to the albumen in a pound of sirloin steak. When potatoes are boiled with the skins removed the greatest actual loss of nutrients seems to be due to the mechanical abrasion of some of the soft outer portions while cooking. In the experiments at the Connecticut (Storrs) Agricultural Experiment Station it was found that nearly 3 per cent. of carbo-hydrates and 4 per cent. of the albuminoid material were lost when potatoes were thus cooked. When the potatoes were boiled with the skins on the loss of nutrients was very slight, consisting chiefly of non-albuminoid nitrogenous substances and mineral matter. It is therefore evident, if it is desired to boil potatoes with as little loss as possible, that the skins should be left on.

Comparatively speaking, there are probably few cases in which it is necessary to take account of the losses due to different methods of boiling potatoes and where the possibility of loss would outweigh the liking for them prepared in some particular way, but in institutions where a large number must be provided for, and, in

fact, under any condition where rigid economy is necessary, the matter may assume considerable importance.

An extended study of the relative composition of large, medium, and small potatoes, and of the different parts of the tubers and of the taste and culinary properties, was recently reported by Coudon and Boussard, two French scientists. The authors believe that the culinary value of potatoes is directly proportional to their nitrogen content and inversely proportional to their starch content. The different varieties of potatoes were found to vary greatly in their resistance to boiling, some retaining their form completely, while others were almost wholly disintegrated. The opinion was advanced that resistance to boiling depends principally upon the relative amount of albuminoids present. No definite relation was observed between chemical composition and early maturity. Generally speaking, the early varieties contained more water and nitrogenous materials and less starch than the late varieties tested.

As regards chemical composition, it may be said in general that boiled potatoes contain a little less water than raw potatoes, and except as this changes somewhat the proportion of nutrients, they differ little in composition from the raw. Mashed potatoes, if they are not seasoned, must necessarily have the composition of the unmashed boiled potato, making allowance for the small proportion of water which would probably be lost by evaporation in mashing. When milk, cream, or butter is added to mashed potatoes in preparing them for the table the nutritive value is increased, though the chief reason for adding such materials is doubtless to improve the flavour. This is also the reason why salt and pepper are added. Baked potatoes have practically the same composition as the uncooked, some water being lost by evaporation. When potatoes are fried, as in making potato chips, they lose by evaporation much of the water present and absorb more or less fat. They therefore have a higher nutritive value, pound for pound, than raw potatoes. Potato chips have been found by analysis to contain 2 per cent. water and 39·8 per cent. fat as compared with 78 per cent. water and 0·1 per cent. fat when raw. The many ways of cooking potatoes, with or without the addition of other materials, which are described in books devoted to cookery, are, in principle, modifications of those already alluded to. The wholesomeness of potatoes cooked in different ways is largely a matter which each must decide for himself, the general experience being that for men in health most of the methods followed are satisfactory.

Evaporated potatoes are now on the market, being especially recommended for provisioning camps and expeditions. As compared with fresh, the evaporated potatoes have a high nutritive value in proportion to their bulk. This is the case with all evaporated foods, such material having been concentrated by the removal of a large proportion of the water originally present.

DIGESTIBILITY OF POTATOES.

In considering the nutritive value of any food, the digestibility must be taken into account, for it is what the body can absorb from any

given material as it passes through the digestive tract, rather than chemical composition, which determines food value. The digestibility of potatoes has been frequently studied. Some years ago Rubner kept a Bavarian soldier who was used to eating large quantities of potatoes on a potato diet for two days. The potatoes were boiled and eaten with salt or with vinegar and oil as a salad. The carbohydrates, the principal nutrative material in the potatoes, were quite thoroughly assimilated. As is usually the case, the digestibility was determined by deducting from the total nutrients present in the food the quantities excreted in the feces. The protein was not well digested. Similar results were obtained by a later German investigator, though in this case the protein was somewhat more thoroughly digested. In this experiment about three-fourths of the crude fibre present was found to be digestible. A number of experiments on the digestibility of potatoes were also made in St. Petersburg by a Russian investigator with three healthy men. Each test was divided into two periods. In one a simple mixed ration was eaten; in the other the food consisted of cooked potatoes only—baked, boiled, or fried in oil. It was found that 93 per cent. of the total dry matter (which in the potato consists largely of starch) was digestible; of the total nitrogen present, 59 per cent.; and of the albuminoid nitrogen, 41 per cent. In experiments on the digestibility of potatoes by man, recently made at the Minnesota Agricultural Experiment Station, it was found that 71·9 per cent. of the protein and 93 per cent. of the carbohydrates were digested or assimilated. In this experiment the potatoes were eaten with some eggs, milk, and cream, so the conditions may be assumed to be about normal. How far the digestibility of any food is influenced by the foods eaten with it is a matter on which little reliable information is available.

The experiments cited above show little, if anything, regarding the ease or rapidity of digestion, and, indeed, trustworthy data of this sort regarding any food are not abundant. According to some investigations made a number of years ago by Beaumont, and which have been frequently quoted, roasted or baked potatoes require somewhat less time than bread for digestion in the stomach (conversion into chyme); boiled potatoes require the same time as bread, namely, three and one-half hours. Too much importance should not be attached to these differences, as no account was taken of digestion in the intestines. As the digestion of starch takes place in the intestinal tract after the food has left the stomach, this is a matter of great importance in the case of starchy foods like the potato. The total length of time the potato remains in the body probably does not vary much with the different methods of cooking. Furthermore, if a person is in health it does not necessarily follow that there is any advantage in digesting one food more rapidly than another.

FLAVOUR OF POTATOES.

The flavour of potatoes depends chiefly on the substances which are dissolved in the juice. These include various mineral

matters, citric acid, and other organic bodies in different combinations. It seems probable that the character of the soil and the amount of moisture it contains exert an influence upon the flavour, as the same varieties of potatoes grown under different conditions vary more or less in this respect. It has been found, for instance, that potatoes manured with muriate of potash yield watery tubers. That such cases may have a marked effect is shown by the extreme case in which potatoes grown in very wet soil sometimes have small tubers above ground in the axils of the leaves instead of under the surface. Such tubers have an unpleasant flavour, and for this reason, if for no other, are unfit for food. The strong, unpleasant flavour of potatoes which have grown at the surface of the ground, and more or less exposed to the influence of light, is familiar. The green colour of such potatoes is due to the chlorophyll formed under the influence of light. The unpleasant flavour is attributed to solanin. Potatoes which have been touched by the frost possess a sweetish flavour. According to analyses of normal and frozen potatoes, this is due to the conversion of some starch into sugar. Normal potatoes were found to contain from 13 to 16 per cent. soluble material and from 84 to 87 per cent. insoluble material, while the percentage of the former in the frozen potatoes ranged from 14 to 20, and of the latter from 80 to 86 per cent. In the normal potatoes starch constituted 67 to 76 per cent. of the total insoluble material, and sugar 0·3 to 0·7 per cent. of the total soluble material. In the frozen potatoes only 58 to 72 per cent. of the total insoluble material was starch, while the sugar amounted to from 0·4 to 1·7 per cent. of the total soluble material. This change of starch into sugar is attributed to the action of a ferment present in potatoes. The explanation seems reasonable, since it is known that ferments play an important part in the chemical processes which take place in plants.

It is undoubtedly true that many persons select fruits and vegetables on the basis of size and appearance, large fruit or vegetables of fine colour being given the preference without regard to their flavour. There are, however, many who realise that different varieties, vary greatly in flavour, and are governed by this fact in their selections. Such discrimination has developed, for instance, a special market for certain finely flavoured varieties of fruits. It is undoubtedly much less common for the purchaser of potatoes to be governed by flavour in his selection of them, and yet the different varieties, or the same variety grown under different conditions, vary greatly in this respect. A smooth potato of good form and size does not necessarily possess a flavour superior to one in which these characteristics are less marked, yet it would perhaps almost always be given the preference by most purchasers. Good flavour in potatoes is a matter worth attention. If purchasers demanded this quality as well as attractive appearance and size, growers would without doubt meet the demand.

PLACE OF POTATOES IN THE DIET.

According to statistics obtained in the large number of dietary studies made in this country, potatoes constitute about 13·7 per

cent. of the total food consumed by the average American family, and furnish not far from 3·9 per cent. of the total protein and 10 per cent. of the total carbohydrates.

The potato is a staple article of diet in almost every household. The universality and extent of its consumption would seem sufficient to prove it to be a wholesome and nutritious food. The statement, however, is frequently met with in popular articles that potatoes are not wholesome. So far as can be learned, this is purely a gratuitous assumption. While it is possible that there are persons with whom they do not agree, or who for some reason are compelled to forego starchy foods, there is no reason to suppose that potatoes are not as a rule a useful and wholesome article of diet.

The potato is essentially a starchy food, and eaten alone it would furnish a very one-sided, badly-balanced diet, which would probably prove unwholesome to most people, as it has been estimated that man in health, performing a moderate amount of muscular work, is best maintained by a diet furnishing daily 0·25 pound protein in addition to fat and carbohydrates enough to make the total fuel value 3,500 calories, while a man without active physical labour might be well nourished with 0·20 pound of protein and 3,000 calories of energy. When the potato is eaten with meat, eggs, fish, etc., which are essentially nitrogenous foods, a well-balanced diet, which is most conducive to health and vigour, is secured.

Scientific investigation shows that the practice, which has become so general, of serving potatoes with meat and other similar foods which contain liberal amounts of protein is based upon correct principles, one food supplying the deficiencies of the other.

Potatoes and other foods containing carbohydrates are sometimes objected to on the ground that they are starchy foods and do not supply much nitrogenous material. It should be remembered, however, that the potato does contain a by no means inconsiderable amount of protein, and further that carbohydrates are an essential part of a well-regulated diet. The digestion experiments referred to above show that potatoes properly cooked furnish such material in a digestible form. They have been a staple article of diet for many years without harmful results, and therefore the conclusion that under ordinary circumstances they are other than a useful and wholesome food seems unwarranted.

POSSIBLE DANGERS FROM EATING POTATOES.

Although under ordinary circumstances potatoes are unquestionably a wholesome food for most persons, illness is sometimes caused by eating them. There are undoubtedly some persons in health with whom potatoes do not agree, just as there are those who cannot eat strawberries without distress. This is due to personal idiosyncrasy and not to the harmful character of the food. Reference cannot be made here to the conditions of ill-health in which potatoes and other starchy foods are forbidden, since this is a subject which pertains to the practice of medicine rather than the subject of

dietetics. Cases of actual poisoning by potatoes are by no means unknown. So far as can be learned, the abnormal symptoms in such cases were caused by the presence of solanin in the potatoes. Several years ago 357 soldiers in a battalion of the Austrian army showed symptoms of solanin poisoning. The potatoes used for food were examined. Those which were fresh contained a small amount of solanin, while those which had sprouted contained much more, still larger amounts being found in the sprouts than in the tubers themselves. The potatoes undoubtedly caused the poisoning in this case. Potatoes a year old which have lain in a cellar and shrivelled, and small potatoes which have sprouted without being planted, are considered especially dangerous, and should not be eaten. If perfectly fresh potatoes contain any solanin, the amount is so small that it does not cause harm.

STOCK AND STATION.

NEWS AND NOTES.

By Norman Malcolm, Inspector of Stock.

Cough Remedy for Cattle.

While the present changeable weather continues, cattle are liable to contract cold, and these are frequently accompanied by a bad cough. The Stock Department has had several cases brought under notice recently, and the Government Veterinary Surgeon recommends the following course of treatment:

Extract of belladonna	6 drams
Gum camphor	6 drams
Spirits nitros ether	1oz.
Water	8oz.

Mix and divide into eight doses, one to be taken daily. Blister the throat with mustard, and keep the cow free from cold or wet for at least a fortnight.

Too Much Corn.

Most horse-owners know the evil effects of feeding too much corn to a horse; but judging from recent inquiries it is not generally known what remedial action should be taken when an animal becomes overheated in consequence of this excessive liberality. Mr. Weir, M.R.C.V.S., advises in such cases the immediate stoppage of all corn in the feed, the substitution of one pound of boiled linseed daily in the bran and chaff, and two ounces of Epsom salts daily in the drinking water.

Bots in Horses.

An exchange states:—"Bots in horses are very prevalent in many parts of this country, and do a considerable amount of injury.

There are so-called remedies in profusion, but very few of them are of any use. The Department of Agriculture in the United States publishes a very simple cure. An experimenter tried a few tests on some live bots taken from the stomach of a horse that had been killed. When put into sage tea they died in fifteen hours; but as that process was too slow, he put others into nitric acid; but that did not seem to trouble them more than water. Some tansy was then bruised, and an infusion made of the juice, and some bots were put into it, when they died under a minute. Having a horse suspected of suffering from bots he gave him some tansy tea in the morning, and a dose of salts in the evening. The next morning the horse's excrement contained one and a half pints of dead bots, and the cure, after repeated trials, is said to be effective."

As this matter is of considerable interest to local horse-owners it was referred to the Government Veterinary Surgeon for his remarks. Mr. Weir states:—"Tansy is frequently used medicinally as a tonic, but is not considered sufficiently powerful to destroy worms. It can be procured in herb form from the chemists. One ounce of tansy, macerated (softened by steeping) for six hours, in a pint of hot water, will be sufficient for one dose for a horse. It should be given in the morning before the animal is fed."

Stock Importations.

The following is a Return showing the number and description of Imported Stock landed at the undermentioned Ports of Western Australia during the Five months ending 31st May, 1902:—

Port.	Breeding Ewes.	Horses.	Fat Cattle.	Sheep.	Dairy Cows and Heifers.	Stud Rams.	Stud Bulls.	Donkeys.	Pigs.	Dogs.
Fremantle ...	90	493	4,689	44,326	391	2,245	164	21	523	56
Albany ...	4	47	...	540	21	2	1	...	...	5
Eucla* ...	...	3	...	...	...	2	...	...	...	...
Geraldton ...	...	5	...	...	1	290	22	...	...	...
Esperance ...	...	5	...	...	...	...	...	...	...	...
Cossack* ...	...	...	...	...	...	142	1	...	...	...
Totals ...	94	553	4,689	44,866	413	2,681	188	21	523	61

* May returns not included.

Tick and Lice in Sheep.

Now that active measures are again being taken by the Stock Department to eradicate tick and lice in sheep, and the policy of 1898, which was abolished by a Select Committee of Inquiry, is once more to be pursued, it will be necessary for sheep-owners throughout the infested areas to make some provision immediately for dipping their flocks. Two inspectors are now exclusively engaged in the Southern, Eastern, and South-Eastern Districts in dealing with this work, and, where practicable, dipping is now being

proceeded with. The scarcity of water, occasioned by the long stretch of dry weather, together with the near approach of lambing, and the weak condition of the sheep, has greatly interfered with the progress of the work for several months, and, in such cases, owners are being served with notice to make preparation for dipping, in the near future, under the supervision of an inspector.

The rapid increase and spread of tick and lice necessitates very vigorous action being taken, and as owners are becoming more appreciative of the benefits of dipping, the Department does not anticipate the opposition now which hindered its operations a few years ago. Those whose flocks were dipped then by compulsion, now invariably admit the necessity for the work, and voluntarily dip their sheep off the shears to insure the freedom of their flocks from these parasites, and reap the benefit of increased prices for their wool.

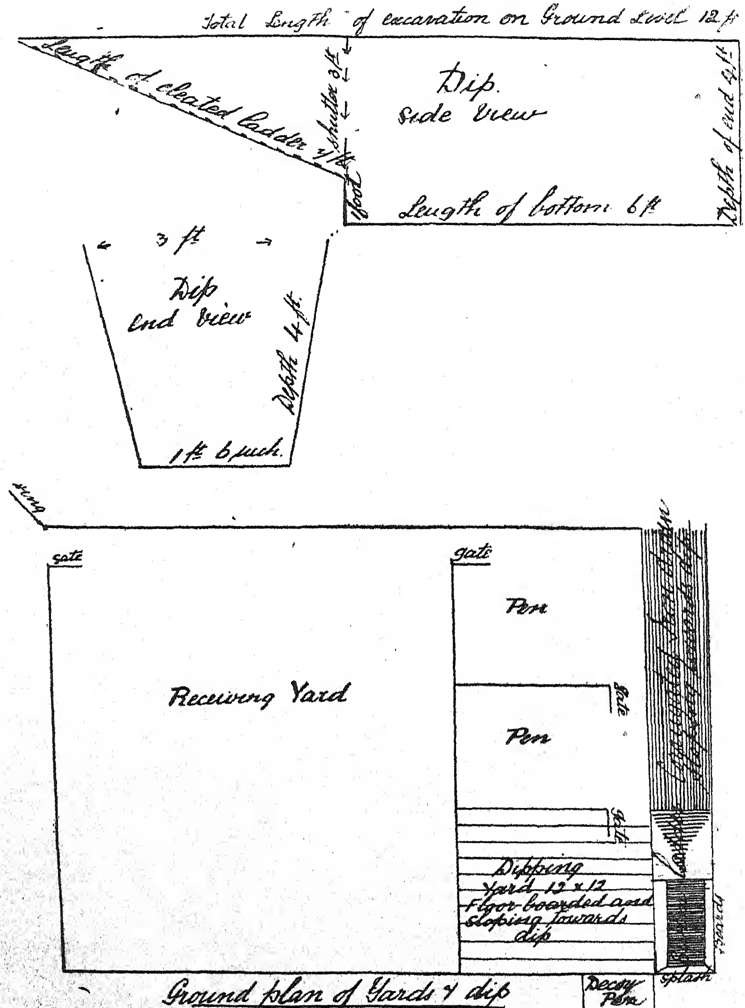
It is only reasonable to admit that sheep grossly infested with tick and lice must be very uncomfortable when constantly accompanied by such an aggravating irritant, and while this discomfort continues it must be admitted that a sheep will not thrive in the same manner as an animal that can take its rest without interruption. Consequently the profits of a farm depend to a very great extent on the clean condition of the sheep, and to the variation of prices for prime and store sheep the farmer must look to compensate him for his labour and enterprise. While increasing his output of mutton and lamb, the yield of wool must not be overlooked, and if by keeping his sheep clean by dipping the owner can offer to the buyer a well-grown sample, in which the staple has not been torn and broken by frequent rubbing and biting to relieve the irritation of these parasites, the extra ½d. or 1d. per lb. received for the wool will more than compensate for the expense and labour of putting the sheep through the dip.

While we have in the State a number of owners who are well-acquainted with the benefits to be gained by dipping, and who take advantage of every means to keep their flocks free from parasitic life, there, unfortunately, are others who neglect to take any action to remedy the trouble, either through want of knowledge of the harmful nature of these parasites, or through obstinacy resulting from a long association with slovenly methods of farming. For the protection of those who are willing and desirous of improving the condition of their flocks, compulsory dipping is therefore necessary, as it is useless for one owner to adopt systematic means of cleaning his sheep while his neighbour continues to breed and disseminate the parasites.

With these conditions in view the flocks in the infested areas are now being closely inspected, and owners would greatly assist the department in its work if they reported the appearance of either tick or lice, as required by the "Stock Diseases Act, 1895." By neglecting to report, and leaving it to an inspector to discover the presence of the parasites, an owner will not escape the necessity to

dip, and he renders himself liable to a severe penalty under the Act for his negligence.

As the inspectors find in travelling through the country that no provision has been made on many farms for the dipping of their sheep, and as in the majority of instances the flocks are small, I publish herewith plans for an inexpensive and serviceable set of yards and dip, which should prove useful to farmers. Furthermore, I would again impress upon all owners of infested flocks the advisability of reporting without delay to the nearest inspector, and of proceeding immediately with the work of constructing their yards and dip.



Plan of Dipping Yards.

MARKET REPORT.

For Month ending 10th June, 1902.

The West Australian Farmers' Co-operative Company, Limited, City Markets, Perth, report sales in undermentioned lines for month ending 10th June, 1902, as follows:—

Farm Produce.—Chaff market has been very barely supplied past month, farmers generally being too busy to forward supplies. Prime chaff in good demand, £4 15s. to £5 per ton; medium and inferior lines, £4 to £4 7s. 6d. per ton. Bran slightly easier, £9 to £9 5s. per ton. Pollard, £9 10s. per ton. Wheat: This line has now reached its limit, as Canadian wheat can be landed in the wheat-growing districts for 5s. per bushel. There is no hope of prices advancing further. Local crop, 5s. to 5s. 6d. per bushel. Flour: Market steady, with easier tendency. Best local flour, £11 to £11 10s.; imported brands, £12 to £12 10s. per ton. Potatoes: Market being cleared gradually. Best local, £9 10s. to £10 per ton. Market glutted with imported lines, £7 to £8 per ton. Onions dull of sale, £8 to £10 per ton. Seed potatoes, £10 to £11 per ton.

Dairy Produce.—Only imported butter offering, principally New Zealand, 1s. 3d. to 1s. 4½d. per lb. No Victorian butter offering. Hams, 1s. 3d. to 1s. 3½d. per lb. Cheese, 8½d. to 10d. per lb. Honey, 4lb. tins, 4s. each; 60lb. tins, 12s. 6d. to 15s. each. Local eggs, 2s. 6d. to 2s. 9d. per dozen.

Fruit.—Local fruit represented principally with apples, oranges, and lemons; apples realising 10s. to 14s. per case for dessert varieties; cooking varieties, 9s. to 10s. per case; inferior lines, from 6s. per case. Local oranges, 10s. to 12s. per case. Lemons, 11s. to 13s. per case. Bananas, 10s. to 20s. per case; green lines, 22s. per case.

Vegetables.—Supplies increasing. Cabbage, 4s. to 6s. 6d. per cwt.; cauliflower, 3s. to 5s. per doz.; beans, 1d. to 2d. per lb.; pumpkins, £4 10s. to £6 per ton; marrows, £5 to £6 per ton; rhubarb, 2d. to 3d. per lb.; beetroot, 2s. 6d. to 3s. per doz.; carrots and parsnips, 1s. 9d. to 2s. per doz. bunches; salads, 6d. to 9d. per doz. bunches.

Poultry.—Market fully supplied. Prime table fowls, 5s. to 5s. 6d. per pair, other lines, 4s. to 4s. 6d. per pair; chickens, 3s. to 3s. 6d. per pair; pure bred fowls, in good demand, at 10s. to 20s. per pair; ducks, 6s. 6d. to 9s. per pair; turkey gobblers, 18s. to 20s. per pair; turkey hens, 10s. to 11s. per pair; geese, 12s. per pair.

Live Stock.—Pigs: Prime porkers, 30s. to 35s. each; forward stores, 25s. to 27s. each; backward stores, 12s. to 18s. each; sucking pigs, 5s. to 8s. each; slips, 10s. to 11s. each; well bred sows, £3 to £4 10s. each. Sheep, 18s. to 26s. each.

Carcase Meat.—Prime porkers, 6½d. to 7d. per lb.; heavy weight pork, 4½d. to 5½d. per lb.; medium weight, 6d. per lb. Mutton, 5¼d. to 5¾d. per lb. Beef, 5¼d. to 5½d. per lb. Veal, 5½d. per lb.

Sundries.—Oilcake, £8 10s. per ton. Bran sacks, new, 4s. to 4s. 3d. per doz.; second-hand, 2s. 9d. per doz. Corn sacks, new, 5s. 9d. per doz.; second-hand, 3s. 9d. per doz. Phosphates, £4 10s. per ton. Bonedust, £7 5s. to £7 10s. per ton.

GARDEN NOTES FOR JULY.

By Percy G. Wicken.

Cold and possibly frosty weather is likely to be the experience of the greater part of the State during this month, and although in some instances the frost may be the means of killing or checking the growth of plants, in other instances it will do a great amount of good, as it is the means of destroying a large number of insects and their larvæ, and also by its action in breaking up the soil and sweetening the ground, the frost having the same effect as the sun for this purpose. In places where the rainfall is heavy, attention should be given to all the drains to see that they are not obstructed by any accumulations of rubbish which will retard the surplus water from getting away. It is not advisable to dig or work the ground when too wet, as this causes it to become hard and caked; unless the soil is very full of humus it is better to leave it for a few days after rain before starting to dig. Wherever available a good liberal dressing of stable manure should be dug into the ground. The general fault committed in using stable manure is in applying too small a quantity; a dressing of 20 tons of manure per acre gives only about 9lbs. per square yard, and if you try spreading this quantity on a square yard of ground you will find it is not so heavy a dressing as is sometimes supposed.

Asparagus.—Prepare land if not already done for planting out the roots next month; dig a trench and mix with the soil plenty of well rotted dung.

Artichokes.—A few rows of this vegetable for early use may be planted, but it is too early for the main crop. The white smooth variety is the best; it requires to be well manured and planted in rows from 3 to 4 feet apart and from 12 to 18 inches apart in the rows.

Broad Beans.—This crop should now be in bearing, but a few more rows may be put in to keep up a succession.

Cabbage.—Sow a little seed of a summer variety, such as the St. John's Day. Plant out from the seed bed any healthy plants you may have available.

Carrots.—Thin out any plants which are growing too thickly, and plant out a little seed to keep up a supply.

Cauliflowers.—Sow a little seed, and plant out all the healthy plants you have ready. Early-sown cauliflowers are now plentiful in the City markets.

Cucumbers.—Those desiring to raise early cucumbers should plant out in hot beds during the month. In warmer localities they may be sown in sheltered spots and covered at night, the plants will then be ready to plant out early in the season.

Lettuce.—Sow a little seed, and plant out any young plants that are ready.

Onions.—Large supplies of this plant should be sown this month; they require a well worked and well drained soil. They may be either sown in drills and thinned out or put in a seed bed and transplanted.

Peas.—May be sown largely during the month; they should be sown in drills from 2 to 4 feet apart, according to the variety. The tall growing variety should be staked, while the dwarf varieties will do on the ground. The best of the tall growing varieties are Yorkshire Hero, Stratagem, Veitch's Perfection, and Telephone. while the dwarf varieties are McLean's Little Gem, William Hurst, and American Wonder. Peas require a good supply of phosphatic and potash manures.

Potatoes.—Early varieties may be sown at the end of the month in localities where there is not likely to be any frost. It is best to cut the tubers and leave about two eyes on each piece when planting.

Turnips.—A few rows for home use may still be sown.

Tomatoes.—A few seeds may be sown under glass or in boxes in well sheltered positions, so as to obtain a supply of young plants for putting out early in the season.

Farm.—The cereal crops should all be sown before the beginning of this month, and consequently the rush of work on the farm should be mostly over for the few winter months. If the land is not too wet, a good harrowing and rolling of the wheat crop when about six inches high will have good results. If the crop is growing at all rank, it is often advisable to run a flock of sheep over the field and eat it down; this causes the wheat to stool out, and also manures the crop. The sheep should not be left too long on the wheat, but a large number put on to eat it down as quickly as possible, and then be removed. Early sown crops of rape, kale, or mustard should now be ready for feeding sheep, and if eaten down, and the sheep removed, a second and sometimes a third crop will follow, which can be fed off as required. In soiling sheep on a growing crop it is better to keep them confined to a small area, and not to let them into too much at one time, otherwise they are likely to tramp the crop down and waste more than they eat. A cheap movable fence is very handy for this purpose, and one that can be readily moved can be constructed at very little expense.

The latter end of the month (July) or early in August is a good time for sowing lucerne seed, and this crop should be much more extensively cultivated than it is. The land requires to be deeply ploughed and to be well worked, and to be quite free from weeds, as the lucerne in its young state is very delicate and easily choked out, but once established it is able to hold its own against weeds, especially if cut for hay, as this keeps the weeds from seeding, and prevents them spreading. Lucerne is easily made into hay, and furnishes plenty of reserve feed for cattle during the winter months, as well as green feed throughout the summer.

THE CLIMATE OF WESTERN AUSTRALIA DURING MAY, 1902.

The long dry summer broke on the 30th April, and fairly heavy rain was general throughout the State during the first few days of the present month. These rains were, however, of a summer rather than a winter type, and included heavy thunderstorms throughout the goldfields. A spell of dry fine weather with high barometers succeeded, and the first real winter rains set in on the 16th, in the South-West District, gradually extending throughout the Western and Southern districts of the State, where it remained showery during the remainder of the month.

The total rainfall was very light and below the average for previous years in the tropics; about or slightly above the normal in West coastal districts, and unusually heavy throughout the South-West districts generally; the maximum recorded at any one locality being 990 points at Point King. On the fields and Murchison it was patchy, but on the whole in excess of the average for the last few years.

Temperature and pressure were fairly normal throughout the State, the former being on the whole slightly above, especially at night, and the latter slightly below. Freezing point on the surface of the ground was reached at four stations, but frosts have not yet started generally. The mean and lowest readings of a minimum thermometer, exposed on the ground, were as follow:—

TERRESTRIAL MINIMUM TEMPERATURE.

	Mean.	Lowest.	Date.
Cue	45·9	32·5	26
Coolgardie	43·0	36·0	26
Southern Cross	41·1	29·5	31
Walebing	42·3	30·0	23
York	43·4	33·8	26
Perth Observatory	47·8	36·9	23
Bridgetown	39·2	32·0	12, 13, 14
Karridale	44·8	35·5	25
Katanning	39·2	29·5	9

The Climate of Western Australia during May, 1902.

Locality.	Barometer (corrected and reduced to sea level).				Shade Temperatures.									Rainfall.	
					May, 1902.					* Average for previous Years.					
	Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
NORTH-WEST AND NORTH COAST:															
Wyndham ...	29·990	29·962	30·155	29·834	92·1	71·6	81·8	95·2	62·0	92·9	71·6	106·0	55·0	*Nil*	2152
Derby	30·000	29·992	30·116	29·858	91·7	63·2	77·4	98·2	56·2	89·7	65·2	102·0	46·0	*Nil*	1477
Broome ...	30·012	29·989	30·143	29·823	89·6	59·6	74·6	95·0	55·5	87·3	61·8	97·3	43·0	6	2053
Condon ...	...	30·040	...	...	83·0	57·6	70·3	87·0	49·0	81·5	55·6	98·0	42·0	39	2019
Cossack ...	30·066	30·016	30·230	29·889	83·4	62·1	72·8	94·2	56·0	82·6	64·2	98·0	47·0	30	1280
Onslow ...	30·046	30·054	30·198	29·894	83·6	59·7	71·6	87·0	50·2	84·2	57·3	103·0	45·0	26	338
Carnarvon ...	30·085	30·038	30·242	29·900	79·4	57·5	68·4	90·5	48·0	81·2	56·5	96·0	43·0	246	439
Hamelin Pool...	30·126	30·082	30·277	29·880	75·8	56·2	66·0	86·4	48·2	77·1	55·8	89·8	44·2	168	280
Geraldton ...	30·106	30·110	30·309	29·783	74·1	57·5	65·8	85·8	49·2	73·0	54·4	93·0	39·3	474	520
INLAND:															
Hall's Creek ...	30·080	...	30·235	29·851	86·1	54·5	70·3	95·0	45·6	84·2	55·4	98·0	36·4	*Nil*	1387
Marble Bar ...	...	...	...	...	87·7	59·0	73·4	93·5	48·5	...	...	...	...	13	1121
Nullagine ...	30·072	...	30·281	29·825	83·2	50·3	66·8	91·0	41·2	80·4	52·4	91·0	38·0	20	1214
Peak Hill ...	30·146	30·112	30·387	29·853	72·2	53·0	62·6	84·3	41·2	72·3	51·6	85·8	40·0	223	1682
Wiluna ...	30·134	...	30·411	29·810	74·0	48·8	61·4	83·8	35·1	...	...	...	...	102	1071
Cue	30·118	30·136	30·367	29·812	74·3	53·0	63·6	87·6	41·8	73·9	50·7	91·0	35·9	57	684
Yalgoo ...	30·096	30·133	30·343	29·848	73·6	50·1	61·8	80·2	38·2	72·2	49·3	92·2	38·0	30	373
Lawlers ...	...	30·161	30·435	29·812	72·2	51·2	61·7	84·2	37·6	69·8	48·5	86·0	34·0	102	696
Laverton ...	30·142	...	30·493	29·798	74·4	50·4	62·4	86·0	33·0	...	...	...	...	146	642
Menzies ...	30·146	30·178	30·493	29·847	69·8	49·6	59·7	83·1	39·5	68·8	47·8	89·0	32·1	136	757
Kalgoorlie ...	30·129	30·178	30·557	29·847	69·5	50·0	59·8	81·7	41·9	68·0	48·0	88·1	34·5	229	579
Coolgardie ...	30·119	30·186	30·524	29·814	69·6	48·7	59·2	80·9	42·0	67·9	47·2	88·4	36·0	220	484
Southern Cross	30·108	30·160	30·475	29·714	70·6	45·7	58·2	79·0	35·5	68·3	44·4	90·0	30·8	91	483
Walebing ...	...	...	...	...	70·1	46·6	58·4	79·0	34·0	...	...	...	...	184	202
Northam ...	...	...	...	...	71·3	46·0	58·6	81·5	36·4	...	...	...	...	144	183
York	30·116	30·128	30·470	29·773	70·8	46·3	58·6	80·0	36·0	68·0	46·2	85·0	30·0	177	179
Guildford ...	...	...	...	...	70·7	49·7	60·2	81·8	39·0	...	...	...	...	515	563

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Climate of Western Australia during May, 1902—*continued*.

Locality.	Barometer (corrected and reduced to sea level). Mean of 9 a.m. and 3 p.m.	*Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. May, 1902. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	* Average for previous Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Total Points since Jan. 1.
SOUTH-WEST AND SOUTH COAST:															
Perth Gardens	30·104	30·118	30·440	29·792	69·7	51·7	60·7	79·3	41·6	70·1	50·5	92·0	34·0	475	515
Perth Observatory	30·114	30·148	30·415	29·792	69·6	52·5	61·0	80·8	40·2	68·8	52·0	82·4	39·9	489	511
Fremantle ...	30·093	30·096	30·411	29·781	68·8	56·3	62·6	80·0	45·2	68·2	53·9	86·0	40·0	443	482
Rottnest ...	30·089	30·126	30·403	29·761	68·5	57·7	63·1	77·0	49·4	68·5	55·4	87·5	40·5	369	409
Mandurah ...	...	...	...	...	69·1	49·9	59·5	80·0	39·0	...	...	...	...	662	710
Wandering ...	...	...	...	...	67·7	42·1	54·9	75·8	34·0	...	...	...	...	322	340
Collie	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Donnybrook ...	...	...	...	...	68·0	46·5	57·2	78·1	35·9	...	...	...	...	611	716
Bunbury ...	30·100	30·111	30·455	29·780	68·9	51·0	60·0	79·0	40·0	67·1	49·8	84·0	33·0	587	645
Busselton ...	...	...	...	...	68·1	47·2	57·6	77·9	37·8	...	...	...	...	468	529
Bridgetown ...	...	...	...	...	67·4	42·2	54·8	78·0	34·0	...	...	...	...	711	787
Karridale ...	30·070	30·132	30·410	29·722	67·6	48·9	58·2	79·2	39·0	67·7	48·8	81·1	32·5	818	1057
Cape Leeuwin	30·037	30·088	30·403	29·594	67·4	57·2	62·3	78·7	50·6	65·8	56·3	77·2	44·9	601	773
Katanning ...	30·093	30·163	30·494	29·835	66·0	46·1	56·0	76·2	36·0	65·4	43·8	79·0	30·5	266	290
Albany ...	30·080	30·104	30·508	29·778	66·6	48·6	57·6	78·8	42·5	63·7	50·4	80·0	37·8	955	1148
Breaksea ...	30·067	30·127	30·496	29·617	66·0	53·0	59·5	78·0	46·0	64·2	54·3	78·2	43·0	652	831
Esperance ...	30·112	30·121	30·549	29·693	70·5	49·3	59·9	84·8	37·6	68·1	49·8	86·0	34·0	370	817
Balladonia ...	30·108	...	30·529	29·608	69·6	46·1	57·8	82·0	35·5	...	...	...	...	125	519
Eyre	30·138	...	30·650	29·846	71·9	48·2	60·0	82·0	36·5	...	...	...	...	162	472

* The figures for previous years have been given whenever there are at least three years' complete records. This number is a very low one upon which to base averages, but otherwise the Goldfields would be excluded.

The Observatory, Perth,
4th June, 1902.

W. E. COOKE,
Government Astronomer.

RAINFALL for April, 1902 (completed as far as possible), and for May, 1902 (principally from Telegraphic Reports).

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
East Kimberley:				
Wyndham	28	1	Nil	...
6-Mile	Nil	...	...	...
The Stud Station	15	1	...	...
Carlton	...	..	...	...
Denham	...	...	...	...
Rosewood Downs	Nil	...	...	...
Argyle Downs	Nil	...	...	...
Lisadell	...	...	...	...
Turkey Creek	Nil	...	Nil	...
Plympton, St. Mary	...	...	...	...
Koojubrin	...	...	...	...
Hall's Creek	Nil	...	Nil	...
Flora Valley	...	...	...	...
Ruby Creek	...	...	...	...
Ruby Plains	...	...	...	...
Denison Downs	Nil	...	Nil	...
West Kimberley:				
Obagama	Nil	...	...	...
Derby	Nil	...	Nil	...
Yeeda	...	...	...	...
Liveringa	Nil	...	...	...
Mt. Anderson	...	...	...	...
Leopold Downs	...	...	...	...
Fitzroy Crossing	Nil	...	Nil	...
Fitzroy (C. Blythe)	...	...	...	...
Quanbun	...	...	...	...
Nookanbah	...	...	...	...
Broome	30	1	6	1
Roebuck Downs	...	...	...	...
Thangoo	Nil	...	...	...
La Grange Bay	Nil	...	1	1
North-West:				
Wallal	Nil	...	Nil	...
Condon	Nil	...	39	5
De Grey River	...	...	...	...
Port Hedland	Nil	...	9	3
Boodarie	Nil	...	...	...
Yule River	...	...	...	...
Warralong	Nil	...	...	...
Muccan	...	...	...	...
Ettrick	Nil	...	...	...
Mulgie	...	...	...	...
Eel Creek	...	...	...	...
Pilbarra	Nil	...	Nil	...
Coongon	...	...	...	...
North-West—*cont.*				
Warrawagine	Nil	...	...	...
Braeside	...	...	...	...
Bamboo Creek	Nil	...	6	2
Marble Bar	Nil	...	13	2
Warrawoona	Nil	...	14	3
Corunna Downs	Nil	...	...	...
Nullagine	Nil	...	20	...
Yandicoogina	Nil	...	...	...
Kerdiadary	Nil	...	...	...
Roy Hill	Nil	...	...	...
Mosquito Creek	...	...	...	...
Mulga Downs	Nil	...	...	...
Woodstock	...	...	...	...
Mt. Florence	...	...	...	...
Tambrey	...	...	...	...
Millstream	Nil	...	...	...
Yandyarra	...	...	...	...
Mallina	Nil	...	...	...
Whim Creek	Nil	...	16	...
Cooyapooya	Nil	...	...	...
Woodbrooke	Nil	...	...	...
Croydon	Nil	...	...	...
Balla Balla	Nil	...	9	1
Roebourne	Nil	...	31	1
Cossack	Nil	...	30	1
Fortescue	Nil	...	...	...
Mardie	Nil	...	...	...
Mt. Stewart	...	...	...	...
Yarraloola	...	...	...	...
Chinginarra	Nil	...	...	...
Onslow	Nil	...	26	3
Peedamullah	...	...	...	...
Red Hill	...	...	...	...
Mt. Mortimer	Nil	..	...	...
Wogoola	...	...	...	...
Nanutarra	Nil	...	...	...
Yanrey	...	...	...	...
Point Cloates	Nil	...	59	...
Gascoyne:				
Winning Pool	Nil	...	302	4
Towara	...	...	...	...
Ullawarra	...	...	...	...
Maroonah	...	...	...	...
Thomas Police Station	...	...	...	...

RAINFALL—*continued.*

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
GASCOYNE—*contd.*				
Bangemall ...	...	...	...	...
Mt. Augustus ...	...	...	...	...
Gifford Creek ...	Nil	...	...	...
Minnie Creek ...	Nil	...	...	...
Yanyeareddy ...	...	...	...	...
Williambury ...	...	...	...	...
Wandagee ...	...	...	...	...
Bernier Island ...	Nil	...	...	...
Boolathana ...	Nil	...	...	...
Carnarvon ...	Nil	...	23	4
Cooralya	...	...	...	...
Doorawarrah ...	...	...	...	...
Mungarra ...	Nil	...	...	...
Clifton Downs ...	Nil	...	...	...
Dairy Creek ...	...	...	...	...
Mt. Clere ...	...	...	...	...
Errivilla	...	...	...	...
Dirk Hartog Island	Nil	...	...	...
Sharks Bay ...	Nil	...	...	...
Kararang ...	...	...	...	...
Meedo	Nil	...	...	...
Tamala	...	...	...	...
Wooramel ...	Nil	...	23	3
Hamelin Pool ...	Nil	...	168	7
Byro	...	...	...	...
Yarra Yarra ...	...	...	...	...
Berringarra ...	Nil	...	...	...
Mt. Gould ...	Nil	...	...	...
Moorarie	...	...	...	...
Peak Hill ...	Nil	...	223	4
Horseshoe ...	Nil	...	...	...
Abbotts	Nil	...	52	5
Belele	...	...	...	...
Mileura	Nil	...	...	...
Milly Milly ...	Nil	...	...	...
Manfred	Nil	...	...	...
Meelya	6	1	...	...
Woogorong ...	Nil	...	...	...
Boolardy	...	...	...	...
Billabalong ...	...	...	...	...
Wooleane ...	Nil	...	...	...
Murgoo	Nil	...	...	...
Meeka	Nil	...	...	...
Mt. Wittenoom ...	Nil	...	...	...
Nannine	Nil	...	115	5
Star of the East...	Nil	...	112	5
Annean	Nil	...	...	...

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
GASCOYNE—*contd.*				
Tuckanarra ...	Nil	...	66	5
Coodardy ...	Nil	...	...	...
Cue	Nil	...	57	4
Day Dawn ...	Nil	...	11	1
Lake Austin ...	Nil	...	31	3
Lennonville ...	Nil	...	40	3
Mt. Magnet ...	Nil	...	45	4
Warracoothara ...	Nil	...	83	5
Challa	Nil	...	...	...
Youeragabbie ...	35	1	...	...
Murrum	Nil	...	...	...
Burnerbinmah ...	Nil	...	...	...
Yalgoo	3	1	30	3
Gabyon	20	1	...	...
Barnong	...	...	21	3
Gullewa	Nil	...	43	5
SOUTH-WEST DIVISION (NORTHERN PART):				
Murchison House	...	...	...	...
Mt. View ...	...	...	...	...
Yuin	23	1	...	...
Northampton ...	Nil	...	243	10
Mt. Erin ...	...	...	...	...
Oakabella ...	Nil	...	...	...
Narra Tarra ...	23	1	...	...
Tibradden ...	Nil	...	254	7
Sand Springs ...	2	1	...	...
Mullewa... ...	Nil	...	138	7
Kockatea ...	1	1	107	5
Bootenal ...	...	...	282	6
Geraldton ...	1	1	474	13
Greenough ...	Nil	...	323	9
Dongara ...	Nil	...	454	7
Dongara (Fearse)	Nil	...	452	9
Strawberry ...	Nil	...	...	...
Mingenew ...	Nil	...	113	12
Rothesay ...	...	...	...	...
Field's Find ...	...	...	...	...
Carnamah ...	Nil	...	150	11
Watheroo ...	Nil	...	232	8
Dandaragan ...	1	1	356	13
Moora	Nil	...	226	12
Yatheroo ...	Nil	...	362	14
Walebing ...	Nil	...	184	14
New Norcia ...	Nil	...	368	14

RAINFALL—*continued.*

Stations.	April.		May.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
South-Western Division, Central (Coastal):				
Gingin	3	1	487	14
Belvoir	2	1	501	15
Mundaring ...	10	2	485	16
Guildford ...	28	3	515	16
Kalbyamba ...	20	3	517	16
Canning W't'r'w'ks	8	2	...	...
Perth Gardens ...	19	2	475	17
Perth Observatory	22	2	489	17
Subiaco	18	3	581	17
Claremont ...	24	2	...	...
Claremont (Richardson)	25	2	...	...
Fremantle ...	30	2	443	15
Rottnest	33	2	369	...
Armadale ...	3	1	464	12
Rockingham ...	32	2	562	14
Canning River ...	2	1	598	16
Jarrahdale ...	20	2	734	14
Mandurah ...	15	2	662	17
Pinjarra	20	2	691	16
Harvey	16	2	687	19
South-West, Central Part (Inland):				
Hatherley ...	Nil	...	236	11
Momberkine ...	Nil	...	198	11
Monghin ...	...	...	260	12
Culham	Nil	...	263	14
Newcastle ...	Nil	...	249	11
Eumalga ...	2	1	265	14
Northam ...	Nil	...	144	10
Grass Valley ...	Nil	...	174	9
Meckering ...	...	...	211	9
Cunderdin ...	Nil	...	...	...
Doongin	Nil	...	145	7
Whitehaven ...	...	...	...	...
Sunset Hills ...	Nil	...	163	9
Cobham	Nil	..	219	13
York	Nil	...	177	13
Beverley ...	Nil	...	132	10
Barrington ...	Nil	...	...	...
Sunning Hill ...	Nil	...	172	9
Wandering ...	2	1	322	16
Pingelly ...	5	1	212	12
Marradong ...	Nil	...	375	13

Stations.	April.		May.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
South-West—*contd.*				
Bannister ...	3	1	...	...
Narrogin ...	Nil	...	187	11
Wickepin ...	Nil	...	...	...
South-West Division (Southern Part):				
Bunbury ...	22	3	587	20
Collie	18	3	...	...
Salvation Army Settlement	15	1	513	16
Glen Mervyn ...	22	2	662	15
Dardanup ...	16	2	533	14
Donnybrook ...	14	2	611	20
Boyanup ...	20	3	701	19
Busselton ...	43	9	468	19
Quindalup ...	...	...	...	...
Margaret River	156	7	...	...
Lower Blackwood	75	4	905	19
Karridale ...	96	15	818	21
Augusta ...	75	11	629	20
Cape Leeuwin ...	76	11	601	24
Biddellia ...	188	8	...	...
The Warren ...	135	7	956	15
Lake Muir ...	43	7	...	...
Mordalup ...	33	7	...	...
Deeside	62	7	...	...
Riverside ...	56	5	...	...
Balbarup ...	69	9	558	19
Wilgarup ...	38	8	584	20
Mandalup ...	23	2	...	...
Bridgetown ...	27	4	711	20
Greenbushes ...	58	5	580	15
Glenrichy ...	25	3	...	...
Williams ...	4	1	394	14
Arthur	6	2	340	16
Darkan	8	1	...	...
Wagin	2	1	262	16
Glencove ...	Nil	...	231	13
Dyliabing ...	Nil	...	...	...
Katanning ...	2	1	266	...
Kojonup ...	6	3	295	18
Broomehill ...	8	3	272	17
Sunnyside ...	4	2	297	12
Woodyarrup ...	2	2	...	...
Cranbrook ...	3	1	...	...
Blackwattle ...	7	1	...	...
Mt. Barker ...	45	7	348	18
Kendenup ...	15	3	465	17

RAINFALL—*continued.*

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
South-West—*contd.*				
St. Werburgh's...	45	5	528	16
Forest Hill ...	50	9	...	...
Denmark ...	76	7	968	...
Albany	70	11	955	18
Point King ...	88	7	990	14
Breaksea ...	46	8	652	15
Wattle Hill ...	...	...	...	...
Cape Riche ...	...	...	...	...
Pallinup ...	6	2	230	13
Bremer Bay ...	18	4	356	15
Jarramongup ...	...	...	...	...
Eastern Division:				
Lake Way ...	Nil	...	102	4
Mt. Sir Samuel ...	Nil	...	68	5
Lawlers	Nil	...	102	7
Leinster G.M. ...	Nil	...	...	...
Lake Darlôt ...	...	...	...	...
Diorite King ...	...	...	...	...
Sturt Meadows...	...	...	...	...
Mt. Leonora ...	Nil	...	94	6
Mt. Malcolm ...	...	...	125	4
Mt. Morgans ...	Nil	...	77	7
Burtville ...	Nil	...	...	...
Laverton ...	Nil	...	146	6
Murrin Murrin...	Nil	...	80	3
The Granites ...	Nil	...	67	4
Tampa	Nil	...	...	...
Kookynie ...	Nil	...	143	3
Niagara	Nil	...	171	...
Yerilla	Nil	...	82	3
Edjudina ...	Nil	...	...	...
Menzies	Nil	...	136	4
Mulline	...	...	...	...
Wangine ...	...	...	...	...
Waverley ...	Nil	...	251	5
Goongarrie ...	Nil	...	193	5
Mulwarrie ...	Nil	...	241	6
Kurawa	Nil	...	219	7
Dixie Gold Mine	Nil	...	...	...
Kurnalpi ...	Nil	...	88	3
Bulong	Nil	...	237	4
Kanowna ...	Nil	...	283	6
Kalgoorlie ...	Nil	...	229	6
Coolgardie ...	4	1	220	6

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
Eastern—*contd.*				
Burbanks P.O. ...	9	1	190	6
Burbanks Birthday Gift	2	1	193	5
Woolubar ...	...	...	...	...
Widgiemooltha...	1	1	202	5
50-Mile Tank ...	20	1	73	5
Norseman ...	22	1	57	7
Bulla Bulling ...	5	1	189	...
Woolgangie ...	Nil	...	...	...
Boorabbin ...	Nil	...	112	7
Karalee	Nil	...	...	...
Yellowdine ...	Nil	...	88	3
Southern Cross...	Nil	...	91	...
Mt. Jackson ...	Nil	...	...	...
Bodallin ...	Nil	...	...	...
Burracoppin ...	Nil	...	...	...
Kellerberrin ...	Nil	...	110	8
Mangowine ...	Nil	...	...	...
Wattoning ...	...	...	...	...
Eucla Division:				
Ravensthorpe ...	15	7	209	6
Coconarup ...	34	6	...	...
Hopetoun ...	18	5	175	10
Fanny's Cove ...	37	4	...	...
Park Farm ...	4	2	...	...
Esperance ...	43	3	370	13
Gibson's Soak ...	14	3	...	..
30-Mile Condenser	16	2	...	...
Swan Lagoon ...	25	3	...	...
Grass Patch ...	9	3	...	...
Myrup	14	2	...	...
Lynburn ...	...	...	...	...
Boyatup... ...	...	...	...	...
Middle Island ...	...	...	...	...
Point Malcolm ...	7	2	...	...
Israelite Bay ...	Nil	...	...	...
Bulbinia ...	...	...	...	...
Frazer Range ...	Nil	...	...	...
Balladonia ...	Nil	...	125	...
Southern Hills ...	Nil	...	...	...
Eyre	2	2	162	13
Madura	...	...	...	...
Mundrabillia ...	33	2	...	...
Eucla	38	5	177	8

The Observatory, Perth,
4th June, 1902.

W. E. COOKE,
Government Astronomer.

Return of Fruit imported into Western Australia during May, 1902.

Name of Port.	No. of Consignments Inspected.	Total No. of Cases.	No. of Cases Passed.	No. of Cases Prohibited.	No. of Cases Destroyed.	No. of Cases of														
						Apples.	Apricots.	Bananas.	Cherries.	Gooseberries.	Lemons.	Peaches.	Oranges.	Passion Fruit.	Pears.	Plums.	Rhubarb.	Pomoloes.	Pines.	All other fruits.
Fremantle ...	84	8662	7925	*737	723	2850	...	2094	...	...	786	...	1348	103	740	...	...	...	...	4
Albany	7	195	187	8	8	55	...	41	...	...	40	...	49	...	2	...	...	...	...	...
Geraldton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury	1	1	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	92	8858	8112	746	732	2905	...	2135	...	...	826	...	1397	103	742	...	...	...	...	4

* 14 cases transhipped.

Department of Agriculture,
7th June, 1902.

Return of Fruit Trees and Plants imported into Western Australia during May, 1902.

Name of Port.	No. of Consignments of Trees or Plants.	Total No. of Trees or Plants in such Consignments.	No. of Consignments passed.	Total No. of Trees or Plants in such Consignments.	No. of Consignments of Trees or Plants prohibited.	Total No. of Trees or Plants in such Consignments.	No. of Packages dipped.	No. of Trees.															
								Ornamental and Pot Plants.	Almonds.	Apples.	Apricots.	Cherries.	Figs.	Lemons.	Limes.	Mulberries.	Oranges.	Peaches.	Pears.	Plums.	Small Fruits.	Vine Cuttings.	All other Trees.
Fremantle ...	17	9777	17	9777	...	...	17	6007	50	72	24	...	8	230	...	...	3284	31	16	44	...	...	11
Albany ...	1	240	1	240	...	...	1	240	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Geraldton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hamelin ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Busselton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bunbury ...	.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...
Esperance ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total ...	18	10017	18	10017	...	...	18	6247	50	72	24	...	8	230	...	...	3284	31	16	44	...	...	11

Department of Agriculture,
7th June, 1902.

By Authority: Wm. Alfred Watson, Government Printer, Perth.